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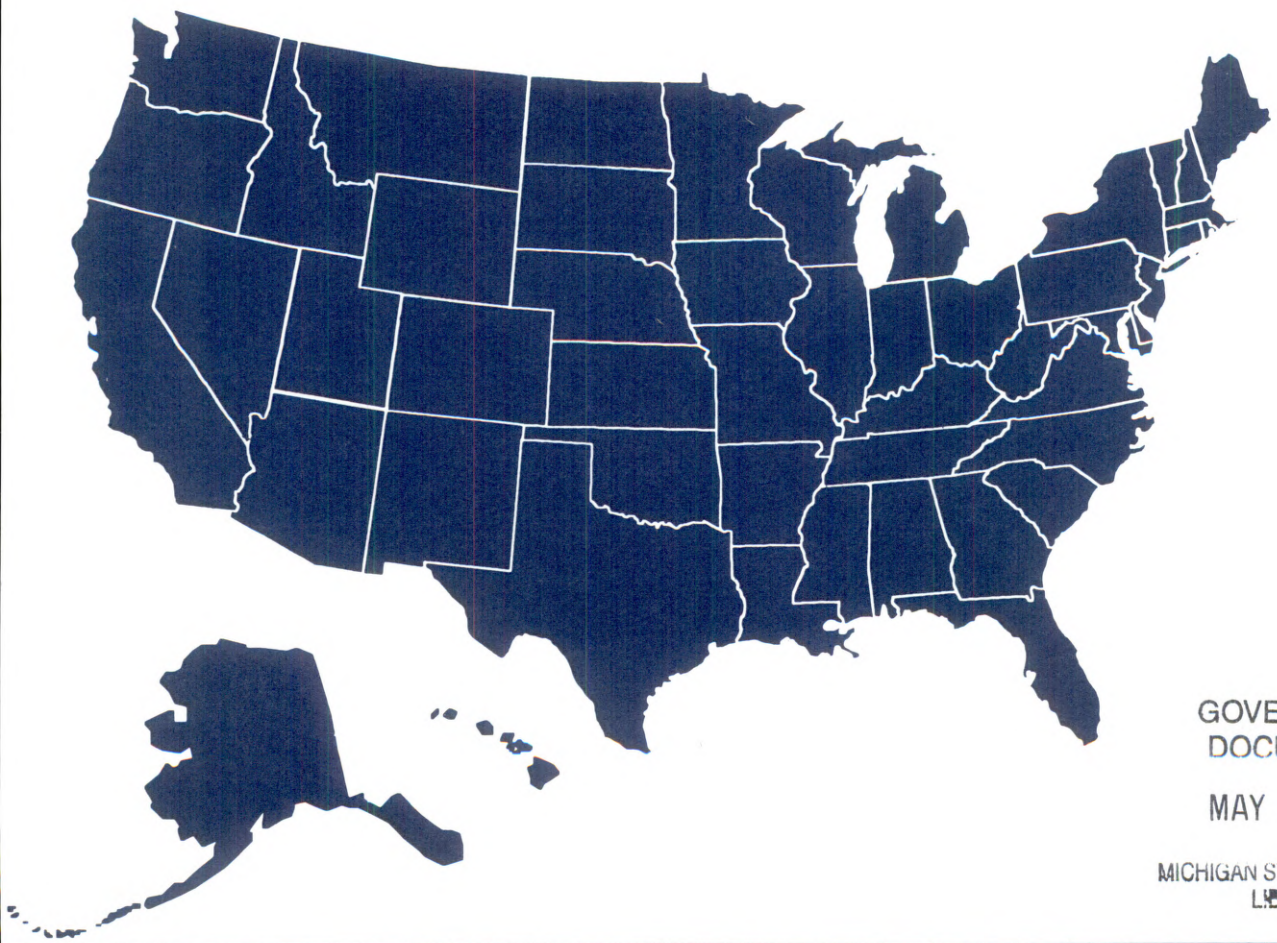
MINERALS YEARBOOK

Area Reports: Domestic 1998

Volume II



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U.S. Department of the Interior
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MINERALS YEARBOOK

Area Reports: Domestic 1998

Volume II

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U.S. DEPARTMENT OF THE INTERIOR
BRUCE BABBITT, Secretary

U.S. GEOLOGICAL SURVEY
CHARLES G. GROAT, Director

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Foreword

This edition of the U.S. Geological Survey (USGS) Minerals Yearbook discusses the performance of the worldwide minerals and materials industry during 1998 and provides background information to assist in interpreting that performance. Content of the individual Minerals Yearbook volumes follows:

- Volume I, Metals and Minerals, contains chapters about virtually all metallic and industrial mineral commodities important to the U.S. economy. Chapters on survey methods, summary statistics for domestic nonfuel minerals, and trends in mining and quarrying in the metals and industrial mineral industries in the United States are also included.
- Volume II, Area Reports: Domestic, contains a chapter on the mineral industry of each of the 50 States and Puerto Rico and the Administered Islands. This volume also has chapters on survey methods and summary statistics of domestic nonfuel minerals.
- Volume III, Area Reports: International, is published as four separate reports. These regional reports contain the latest available minerals data on more than 190 foreign countries and discuss the importance of minerals to the economies of these nations and the United States. Each report begins with an overview of the region's mineral industries during the year. It continues with individual country chapters that examine the mining, refining, processing, and use of minerals in each country of the region and how each country's mineral industry relates to U.S. industry. Most chapters include production tables and industry structure tables, information about Government policies and programs that affect the country's mineral industry, and an outlook section.

The USGS continually strives to improve the value of its publications to users. Constructive comments and suggestions by readers of the Minerals Yearbook are welcomed.

Charles G. Groat
Director

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Contacts

Information about the U.S. Geological Survey, its programs, staff, and products may be accessed on the World Wide Web at URL http://www.usgs.gov/ or by contacting the Earth Science Information Center at 1-888-ASK-USGS. For specific information about this publication, contact the Chief, Publication Services Section, Minerals Information Team, at (703) 648-4750. Additional minerals information may be accessed on the World Wide Web at URL http://minerals.usgs.gov/minerals/.

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Acknowledgments

The volume was produced by Arnold Tanner and Roger Loebenstein, both Physical Scientists with the Minerals Information Team of the U.S. Geological Survey (USGS). Domestic nonfuel raw mineral production data and tables were prepared by Stephen Smith, Industry Data Analyst; crushed stone data and tables were prepared by Susan Copeland, Statistical Assistant; and construction sand and gravel data and tables were prepared by Cheryl Crawford, Statistical Assistant. All mineral commodity rankings and statistical analyses were performed by Mr. Tanner and were based on data reported to the USGS by companies responding to the annual canvasses of nonfuel mineral producers in the United States. Mineral production data and related rankings for 1998 are preliminary owing to publication of this volume before final data for all mineral commodities were available. Data and related rankings prior to 1998 are from final tabulations. For crushed stone and construction sand and gravel, each State chapter includes tabular data by State aggregate districts, where applicable, based on final 1997 data. Compilations of data contained in this volume were largely based on statistics and other data provided by the mineral industries. The USGS gratefully acknowledges the willing contribution of these essential data by both companies and individuals. Information regarding a State's mining industry, mineral exploration, and other mining-related activities or legislation was derived from information submitted by officials from each participating State. We thank those State agencies that contributed mining and minerals industry information for their States. Their submissions significantly broadened the scope of those chapters; their participation in this joint project is greatly appreciated. Authors of text submissions from participating States are referenced by footnote in each chapter as appropriate. All chapters underwent technical review by USGS mineral commodity specialists and other agency professionals. The melding of their knowledge and expertise into this project was invaluable in producing accurate individual documents and is greatly appreciated. Each of these State chapters was published previously as a State annual review in the USGS "Mineral Industry Surveys" series. Maps indicating "major producing areas" lead off each respective chapter. The State maps were fully updated and revised in November 1995 in collaboration with the State Geologists and/or minerals information agency Directors of each State. The State maps are updated annually as new information is received from State agencies, USGS mineral commodity specialists, and other sources.

In the collection of statistical and other mineral industry information, the USGS also was assisted by various State agencies through cooperative memoranda of understanding (MOU's). Some of the chapters in this publication were reviewed by staff members of these State agencies. Our sincere appreciation for all agency cooperation is extended to the State and Commonwealth government agencies which have MOU's with the USGS. These are as follows:

Alabama: Geological Survey of Alabama.
Arizona: Arizona Department of Mines and Mineral Resources.
Arkansas: Arkansas Geological Commission.
California: California Department of Conservation, Division of Mines and Geology.
Colorado: Colorado Geological Survey.
Connecticut: Connecticut Geological and Natural History Survey.
Delaware: Delaware Geological Survey.
Florida: Florida Geological Survey.
Georgia: Georgia Geologic Survey.
Idaho: Idaho Geological Survey.
Illinois: Illinois State Geological Survey.
Indiana: Indiana Geological Survey.
Iowa: Iowa Geological Survey Bureau.
Kansas: Kansas Geological Survey.
Kentucky: Kentucky Geological Survey.
Louisiana: Louisiana Geological Survey.
Maine: Maine Geological Survey.
Maryland: Maryland Department of the Environment, Minerals, Oil, and Gas Division.
Massachusetts: Massachusetts Executive Office of Environmental Affairs.
Michigan: Michigan Department of Environmental Quality, Geologic Survey Division.
Mississippi: Mississippi Department of Environmental Quality, Office of Geology.
Missouri: Missouri Department of Natural Resources, Division of Geology and Land Survey.
Montana: Montana Bureau of Mines and Geology.
Nebraska: University of Nebraska-Lincoln, Nebraska Geological Survey.
Nevada: Nevada Bureau of Mines and Geology.
New Hampshire: New Hampshire Department of Environmental Services.
New Jersey: New Jersey Geological Survey.

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New Mexico: New Mexico Bureau of Mines and Mineral Resources.
New York: New York State Geological Survey.
North Carolina: North Carolina Geological Survey.
North Dakota: North Dakota Geological Survey.
Ohio: Ohio Department of Natural Resources, Division of Geological Survey.
Oklahoma: Oklahoma Geological Survey.
Pennsylvania: Pennsylvania Bureau of Topographic and Geologic Survey.
Puerto Rico: Department of Natural Resources, Bureau of Geology.
Rhode Island: University of Rhode Island Department of Geology, Office of the State Geologist.
South Carolina: South Carolina Geological Survey.
South Dakota: South Dakota Geological Survey.
Tennessee: Tennessee Department of Environment and Conservation, Division of Geology.
Texas: The University of Texas at Austin, Bureau of Economic Geology.
Utah: Utah Geological Survey.
Vermont: Vermont Geological Survey.
Virginia: Virginia Department of Mines, Minerals and Energy.
Washington: Washington State Department of Natural Resources, Division of Geology and Earth Resources.
West Virginia: West Virginia Geological and Economic Survey.
Wisconsin: Wisconsin Geological and Natural History Survey.
Wyoming: Wyoming State Geological Survey.

John H. DeYoung, Jr.
Chief Scientist, Minerals Information Team

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Contents

Foreword, by Charles G. Groat iii
Contacts iv
Acknowledgments, by John H. DeYoung, Jr. v
Survey Methods for Nonfuel Minerals, by Kenneth W. Mlynarski 1.1
Preliminary Statistical Summary, by Stephen D. Smith 2.1
The Mineral Industry of—
Alabama 3.1
Alaska 4.1
Arizona 5.1
Arkansas 6.1
California 7.1
Colorado 8.1
Connecticut 9.1
Delaware 10.1
Florida 11.1
Georgia 12.1
Hawaii 13.1
Idaho 14.1
Illinois 15.1
Indiana 16.1
Iowa 17.1
Kansas 18.1
Kentucky 19.1
Louisiana 20.1
Maine 21.1
Maryland 22.1
Massachusetts 23.1
Michigan 24.1
Minnesota 25.1
Mississippi 26.1
Missouri 27.1
Montana 28.1
Nebraska 29.1
Nevada 30.1
New Hampshire 31.1
New Jersey 32.1
New Mexico 33.1
New York 34.1
North Carolina 35.1
North Dakota 36.1
Ohio 37.1
Oklahoma 38.1
Oregon 39.1
Pennsylvania 40.1
Puerto Rico 41.1
Rhode Island 42.1
South Carolina 43.1
South Dakota 44.1
Tennessee 45.1
Texas 46.1
Utah 47.1
Vermont 48.1
Virginia 49.1
Washington 50.1
West Virginia 51.1
Wisconsin 52.1
Wyoming 53.1
Directory of State Geologists and State Minerals Information Personnel 54.1

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SURVEY METHODS FOR NONFUEL MINERALS

By Kenneth W. Mlynarski

The U.S. Geological Survey (USGS) collects worldwide data on virtually every commercially important nonfuel mineral commodity. These data form the base for tracking and assessing the health of the minerals sector of the U.S. economy.

The USGS data collection activity was instituted by the 47th Congress in the appropriations act of August 7, 1882 (22 Stat. 329), which placed the collection of mineral statistics on an annual basis. The most recent authority for the USGS survey activity is the National Materials and Minerals Policy, Research and Development Act of 1980 (Public Law 96-479, 96th Congress). This act strengthens protection for proprietary data provided to the U.S. Department of the Interior by persons or firms engaged in any phase of mineral or mineral-material production or consumption.

Data Collection Surveys

The USGS begins the collection of domestic nonfuel minerals and materials statistics by appraising the information requirements of Government and private organizations of the United States. Requirements that can be met by collecting data from minerals establishments are posed as questions on USGS surveys. Figure 1 shows a typical survey form.

Specific questions about mineral commodity activities, such as production, consumption, and shipments, are structured in the survey forms to provide meaningful aggregated data. Thus, the entire mineral economic cycle from production through consumption is covered by 144 monthly, quarterly, semiannual, and annual surveys.

After the survey form has been designed, a list of the appropriate establishments to be canvassed is developed. Many sources are used to determine which companies, mines, plants, and other operations should be included on the survey mailing list. State geologists, Federal organizations (e.g., Mine Safety and Health Administration), trade associations, industry representatives, and trade publications and directories are some of the sources that are used to develop and update survey listings. With few exceptions, a complete canvass of the list of establishments is used rather than a sample survey. The iron and steel scrap industry is one of the exceptions where a sample survey is conducted.

The Paperwork Reduction Act requires that any Government agency wanting to collect information from 10 or more individuals or establishments must first obtain approval from the Office of Management and Budget (OMB). OMB approves the need to collect the data and protects industry from unwarranted Government paperwork.

Survey Processing

The USGS surveys approximately 18,000 establishments. Each year, the USGS mails about 40,000 forms for 141 different surveys. Each completed survey form returned to the USGS undergoes extensive analysis to ensure the highest possible accuracy of the mineral data. The statistical staff monitors all surveys to ensure that errors are not created by reporting in physical units different from the units requested on the form. Relations between related measures, such as produced crude ore and marketable crude ore, are analyzed for consistency. Engineering relations, such as recovery factors from ores and concentrates, also are used. The totals for each form are verified, and currently reported data are checked against prior reports to detect possible errors or omissions.

For the majority of the surveys, which are automated, the forms are reviewed to ensure that data are complete and correct before entering into the computer. The computer is programmed to conduct a series of automated checks to verify mathematical consistency and to identify discrepancies between the data reported and logically acceptable responses.

The USGS is modernizing and automating all its survey-processing and data-dissemination functions. Automated commodity data system functions include computerized preparation of statistical tables, the use of desktop publishing to integrate text and tables, and electronic dissemination through the Internet. Also, information on minerals and mineral-related publications is available through an easy-to-use automated fax response system known as MINES FaxBack.

Survey Responses.—To enable the reader to understand better the basis on which the statistics are calculated, each commodity annual report includes a section entitled "Domestic Data Coverage." This section briefly describes the data sources, the number of establishments surveyed, the response percentage, and the method of estimating the production or consumption for nonrespondents.

To produce reliable aggregated data, the USGS uses efficient procedures for handling instances of nonresponse. Failure to return the initial survey form results in a second mailing of the form. If the second form is not returned, then telephone calls are made to the nonrespondents. The follow-up calls provide the necessary data to complete the survey forms and/or to verify questionable data entries. Periodic visits to minerals establishments also are made by USGS mineral commodity specialists to gather missing data and to explain the importance of the establishment's reporting. By describing the use of the published statistics and showing the

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impact of nonresponse, the USGS strives to encourage respondents to give a complete and accurate reply.

The OMB publication "Guidelines for Reducing Reporting Burden" stipulates that the minimum acceptable response rate shall be 75% of the panel surveyed. In addition, the USGS strives for a minimum reporting level of 75% of the quantity produced or consumed (depending on the survey) for certain key statistics. Response rates are periodically reviewed. For those surveys not meeting the minimum reporting level, procedures are developed and implemented to improve response rates.

Estimation for Nonresponse.—When efforts to obtain a response to a survey fail, it becomes necessary to use estimation or imputation techniques to account for missing data. Some of the estimation methods depend on knowledge of prior establishment reporting, and other techniques rely on external information to estimate the missing data. When survey forms are received after the current publication has been completed, the forms are edited, necessary imputations are made for missing data, and the survey data base is updated. The revised data are reported in later publications.

Protection of Proprietary Data.—The USGS relies on the cooperation of the U.S. minerals industry to provide the mineral data that are presented in this and other USGS publications. Without a strong response to survey requests, the USGS would not be able to present reliable statistics. The USGS, in turn, respects the proprietary nature of the data received from the individual companies and establishments. To ensure that proprietary rights will not be violated, the USGS analyzes each of the aggregated statistics to determine if the data reported by an individual establishment can be deduced from the aggregated statistics. If, for example, only two significant producers of a commodity are in a given State, then the USGS will not publish the State total because either producer could readily estimate the production of the other. It is this obligation to protect proprietary information that results in the withheld, or W, entries in the published tables. If a company gives permission in writing, however, then the USGS will publish the data as long as the data from other respondents are protected from disclosure.

International Data

International data are collected by USGS country specialists and international data coordinators. The data are gathered from various sources, including published reports of foreign Government mineral and statistical agencies, international organizations, the U.S. Department of State, the United Nations, the Organization of Petroleum Exporting Countries, and personal contact by specialists traveling abroad. Each February, an annual Minerals Questionnaire is sent to foreign organizations asking them to provide estimates of mineral production for the host country for the preceding year. Missing data are estimated by USGS country specialists historical trends and the specialist's knowledge of current production capabilities in each country.

Publications

The USGS disseminates current and historical minerals information through a broad range of printed publications.

The Minerals Yearbook summarizes annually, on a calendar-year basis, the significant economic and technical developments in the mineral industries. Three volumes are issued each year: Volume I, Metals and Minerals; Volume II, Area Reports, Domestic; and Volume III, Area Reports, International. Chapters in Volume I and Volume II are issued separately as annual Mineral Industry Surveys (MIS) before the bound volume is available. Volume I of the Minerals Yearbook presents, by mineral commodity, salient statistics on production, trade, consumption, reserves, and other measures of economic activity. Volume II of the Minerals Yearbook reviews the U.S. minerals industry by State and island possessions. Volume III of the Minerals Yearbook is published as four separate regional reports covering more than 190 foreign countries.. The regional reports contain individual country chapters that examine the mining, refining, processing, and use of minerals in each country in the region and how they relate to U.S. industry.

The MIS contain timely statistical and economic data on minerals. The surveys are designed to keep Government agencies and the public, particularly the mineral industry and the business community, informed of trends in the production, distribution, inventories, and consumption of minerals. Frequency of issue depends on the demand for current data. The MIS are released monthly, quarterly, semiannually, and annually.

Mineral Commodity Summaries, an up-to-date summary of about 80 nonfuel mineral commodities, is the earliest Government publication to furnish estimates covering the previous year's nonfuel mineral industry data. It contains information on the domestic industry structure, Government programs, tariffs, 5-year salient domestic statistics, and a summary of international mining news.

Metal Industry Indicators, published monthly, contains indexes that measure the current and future performance of five U.S. metal industries. For each of the five industries, a composite coincident index and a composite leading index have been developed on the basics of procedures and data similar to those used to construct the Conference Board's coincident and leading cyclical indicators for the national economy.

The MIS and the Metal Industry Indicators are available at no charge from Publication Distribution, Cochrans Mill Road, P.O. Box 18070, Pittsburgh, PA 15236, (412) 892-4338.

Minerals Yearbooks and Mineral Commodity Summaries may be purchased from the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402, (202) 512-1800.

Mineral Commodity Summaries also may be purchased from the National Technical Information Service, Springfield, VA 22161, 1-800-553-NTIS (in Virginia and foreign countries, 1-703-487-4650).

Some USGS minerals information publications are also

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available on a CD-ROM format. The CD-ROM is updated three times per year. It is available from the Government Printing Office at the address and phone number listed above.

Electronic Data Dissemination

In addition to the USGS's printed publications, current information on minerals and mineral-related publications from the USGS is available through an easy-to-use automated fax response system. The MINES FaxBack service allows callers to retrieve information and order some publications for delivery to their fax machines in minutes, 24 hours per day, 7 days per week. MINES FaxBack makes monthly, quarterly, and annual MIS publications available to the public at the same time they are forwarded to the printer.

MINES FaxBack works from any Group III-compatible fax machine equipped with a touch-tone telephone (either a built-in handset with touch-tone capability or a separate touch-tone telephone plugged into the fax machine's phone jack). After calling MINES FaxBack, the requestor is guided by a series of voice messages that assist the caller in ordering the desired documents. The caller pays for the phone call that also includes the time needed to deliver the requested document to the caller's fax machine.

To access the MINES FaxBack System, use a touch-tone handset attached to a fax machine or connect a touch-tone telephone to the fax machine's telephone jack and dial (703) 648-4999. Listen to the menu options and select an option using the touch-tone telephone. After completing a selection, press the start button on the fax machine.

The USGS also has a minerals information page on the World Wide Web detailing publications, information products, and contacts for minerals information. The URL is http://minerals.usgs.gov/minerals/. The page also contains links to other mining-related sites on the Internet.

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FIGURE 1
A TYPICAL SURVEY FORM

USGS Form 9-4126-A
Nonfer. (rev. 3/31/98)

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986 NATIONAL CENTER
RESTON, VIRGINIA 20192

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Unless authorization is granted in the section above the signature, the data furnished in this report will be treated in confidence by the Department of the Interior, except that they may be disclosed to Federal defense agencies, or to the Congress upon official request for appropriate purposes. Unless objection is made in writing to the USGS, the information furnished in this report may be disclosed to the respondent's State Geological Survey (or similar State Agency) if the State has appropriate safeguards to prevent disclosing company proprietary data.

(Please correct if name or address has changed.)

FACSIMILE NUMBER
1-800-543-0661

This survey is exempt from requirements of the Paperwork Reduction Act (44 U.S.C. 35) and does not require clearance from OMB. The USGS relies on your voluntary and timely response to assure that its information is complete and accurate. This form is designed to supplement Form 6-1151-MA. Please return this form in the enclosed envelope or fax to the above toll-free number. Complete a separate form for each mineral establishment that was active during the reporting period. A mineral establishment is defined as a single physical location where mineral operations are conducted; for example, a mine only, a mine and preparation plant, or a preparation plant only. If you do not have exact data, please enter your best estimates and mark with an /e. Use zero (0) when appropriate. Do not report decimals or fractions. Round to the nearest whole number. If you have nothing to report, please complete "Location of plant", sign, and return the form. Please do not make entries in shaded areas.

Please use the space for "Remarks" to provide any specific information that will help us in the use or interpretation of the data. Any statement on the effect of changes in economic conditions upon the reporting establishment will be useful. Additional forms are available upon request. If you have any questions concerning completion of this form, please contact the Mineral Commodities Data Unit, U.S. Geological Survey, 985 National Center, Reston, VA 20192, Telephone (703) 648-7960.

1. Location of plant: City or town _____ State _____

2. Zinc consumed in manufacture of rolled zinc.
This is a measure of zinc entering the rolling mill for the first time. Do not include clippings originating from manufacturing finished products (coin blanks, battery cans, etc.) in your own fabricating plant.

Type of zinc consumed (1)	Code	Stocks at plant at beginning of year *(gross weight - pounds)* (2)	Receipts during year *(gross weight - pounds)* (3)	Melted or consumed during year *(gross weight - pounds)* (4)	Stocks at plant end of year *(gross weight -pounds)* (5)
Zinc scrap	301				
Slab zinc	302				
Other *(specify)*_____	303				

3. Production and stocks of rolled zinc, by type.

Item (1)	Code	Stocks at plant at beginning of year *(gross weight - pounds)* (2)	(3)	Production during year *(gross weight - pounds)* (4)	Stocks at plant end of year *(gross weight - pounds)* (5)
Strip foil	402				
Rod and wire	405				
Coin alloy	406				
Other *(specify)*_____	407				
TOTAL	408				

Remarks:

Name of person to be contacted regarding this report			Tel. area code	No.	Ext.
Address	No.	Street	City	State	ZIP Code

May tabulations be published which could indirectly reveal the data reported above? ☐ (1) Yes ☐ (2) No

Signature	Title	Date

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PRELIMINARY STATISTICAL SUMMARY

This preliminary report summarizes data on crude nonfuel mineral production[1] for the United States, its island possessions, and the Commonwealth of Puerto Rico.

Although crude mineral production may be measured at any of several stages of extraction and processing, the stage of measurement used in this annual report is what is termed "mine output." This term refers to minerals or ores in the form in which they are first extracted from the ground, but customarily may include the output from auxiliary processing at or near the mines.

Because of inadequacies in the statistics available, some series deviate from the foregoing definition. For copper, gold, lead, silver, tin, and zinc, the quantities shown are recorded on a mine basis (as the recoverable content of ore sold or treated). However, the values assigned to the quantities are based on the average selling price of refined metal, not the mine value. Mercury is measured as recovered metal and valued at the average New York price for the metal. Values shown are in current dollars, with no adjustments made to compensate for changes in the purchasing power of the dollar.

The preliminary total value of all nonfuel mineral production in the United States decreased about 1% to $40 billion in 1998, with metals decreasing by 14% to $11.3 billion and industrial minerals increasing by 5% to $28.8 billion over that of 1997. Nine of the mineral commodities produced in the United States in 1998 had an individual total production value greater than $1 billion. These commodities, in descending order, were stone (crushed), cement (portland), sand and gravel (construction), gold, copper, iron ore (usable), lime, phosphate rock, and clays (kaolin). They composed almost 76% of the U.S. total production. (*See table 1.*)

In 1998, 13 States produced nonfuel mineral commodities with individual total production values of greater than $1 billion. These States, in descending order, were Nevada, California, Arizona, Florida, Texas, Georgia, Michigan, Minnesota, Missouri, Utah, Pennsylvania, Ohio, and Wyoming. They composed slightly more than 60% of the U.S. total production. (*See table 3.*)

---

[1]The terms "nonfuel mineral production" and related "values" encompass variations in meaning, depending on the minerals or mineral products. Production may be measured by mine shipments, mineral commodity sales, or marketable production (including consumption by producers) as is applicable to the individual mineral commodity.

All 1998 USGS mineral production data published in this chapter are estimates as of December 1999. For some commodities (for example, construction sand and gravel, crushed stone, and portland cement), data are updated periodically. To obtain the most current information, please contact the appropriate USGS mineral commodity specialist. A telephone listing for the specialists may be retrieved over the Internet at http://minerals.usgs.gov/minerals/contacts/comdir.html; by using MINES FaxBack at (703) 648-4999 from a fax machine with a touch-tone handset (request Document # 1000 for a telephone listing of all mineral commodity specialists); or by calling USGS information at (703) 648-4000 for the specialist's name and number. All Mineral Industry Surveys–mineral commodity, State, and country–also may be retrieved over the Internet at http://minerals.usgs.gov /minerals; facsimile copies may be obtained from MINES FaxBack.

[2]Values, percentage calculations, and rankings for 1997 may vary from the *Minerals Yearbook, Area Reports: Domestic 1997, Volume II*, owing to the revision of preliminary to final data. Data for 1998 are preliminary and expected to change, while related rankings may also be subject to change.

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TABLE 1
NONFUEL MINERAL PRODUCTION IN THE UNITED STATES p/ 1/ 2/

(Thousand metric tons and thousand dollars unless otherwise specified)

Mineral		1996 Quantity	1996 Value	1997 Quantity	1997 Value	1998 p/ Quantity	1998 p/ Value
Metals:							
Antimony 3/	metric tons	242	W	356	W	W	W
Beryllium concentrates	do.	5,260	6	5,760	6	5,750	6
Copper 4/		1,920	4,610,000	1,940	4,580,000	1,850	3,270,000
Gold 4/	kilograms	326,000	4,090,000	362,000 r/	3,870,000 r/	350,000	3,330,000
Iron ore, usable		62,200	1,770,000	62,800	1,890,000	60,200	1,970,000
Iron oxide pigments, crude	metric tons	44,700	6,990	46,900	7,580	46,400	7,510
Lead 4/	do.	426,000	459,000	448,000	460,000	448,000	444,000
Magnesium metal	do.	133,000	455,000	125,000	400,000	117,000	374,000
Molybdenum 3/	do.	57,900	456,000	59,100	W	53,500	W
Nickel ore 5/	do.	1,330	W	--	--	--	--
Palladium	kilograms	6,100	25,500	8,400	49,700	11,100	67,800
Platinum	do.	1,840	23,500	2,610	33,200	3,460	45,200
Rare-earth metal concentrates	metric tons	20,400	W	20,000 e/	W	10,000 e/	W
Silver 4/	do.	1,570	262,000	2,150	338,000	2,100	344,000
Zinc 4/	do.	598,000	674,000	605,000	860,000	655,000	753,000
Combined value of bauxite, manganiferous ore, mercury, titanium concentrates, tungsten, vanadium, zirconium concentrates, and values indicated by symbol W		XX	190,000	XX	614,000	XX	653,000
Total metals		XX	13,000,000	XX	13,100,000	XX	11,300,000
Industrial minerals, excluding fuels:							
Asbestos	metric tons	9,550	W	6,890	W	W	W
Barite		662	14,700	692	15,500	660	15,000
Boron minerals, B2O3		1,150	519,000	604 6/	580,000	619 6/	440,000
Bromine	metric tons	227,000	150,000	247,000	198,000	234,000	226,000
Cement:							
Masonry		3,470	321,000 e/	3,630	339,000 e/	3,700	356,000 e/
Portland		75,800	5,310,000 e/	78,900	5,710,000 e/	81,800	6,050,000 e/
Clays:							
Ball		973	43,100	1,040	48,100	1,130	52,300
Bentonite		3,740	134,000	4,020	169,000	4,030	162,000
Common		26,200	144,000	24,500	149,000	24,900	152,000
Fire		505	10,700	649	9,450	604	11,300
Fuller's earth		2,600	278,000	2,370	255,000	2,500	275,000
Kaolin		9,120	1,100,000	9,410	1,040,000	9,770	1,090,000
Diatomite		698	176,000	766	184,000	767	182,000
Feldspar	metric tons	890,000	39,400	900,000	42,500	800,000	40,000
Fluorspar	do.	8,180	W	--	--	--	--
Garnet, industrial	do.	60,900	5,630	64,900	6,050	57,200	5,420
Gemstones		NA	43,300	NA	25,000	NA	22,900
Gypsum, crude		17,500	124,000	18,600	132,000	18,500	133,000
Helium:							
Crude	million cubic meters	37	33,100	37	33,700	39	35,300
Grade-A	do.	97	193,000	104	206,000	105	208,000
Iodine	metric tons	1,270	14,600	1,320	19,600	1,340	24,500
Lime		19,200	1,160,000	19,600	1,200,000	20,400	1,200,000
Mica, crude		97	7,820	114	9,400	81	9,020
Peat		640	18,500	750	17,500	611	17,600
Perlite, crude	metric tons	684,000	21,300	706,000	23,300	688,000	24,800
Phosphate rock, marketable		45,400	1,060,000	45,900	1,080,000	44,600	1,140,000
Potash		2,960	299,000	3,000	320,000	W	W
Pumice and pumicite	metric tons	612,000	14,800	577,000	16,100	616,000	15,100
Salt		42,900	1,060,000	40,600	993,000	40,700	965,000
Sand and gravel:							
Construction		914,000	4,000,000	952,000	4,260,000	1,020,000	4,710,000
Industrial		27,800	497,000	28,500	518,000	29,000	530,000
Silica stone 7/	metric tons	410	4,050	445	2,560	NA	NA
Sodium compounds:							
Soda ash		10,200	926,000	10,700	915,000	10,300	840,000
Sodium sulfate, natural		306	27,200	318	34,700	290	29,000

See footnotes at end of table.

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TABLE 1--Continued
NONFUEL MINERAL PRODUCTION IN THE UNITED STATES p/ 1/ 2/

(Thousand metric tons and thousand dollars unless otherwise specified)

Mineral	1996		1997		1998 p/	
	Quantity	Value	Quantity	Value	Quantity	Value
Industrial minerals, excluding fuels--Continued:						
Stone, crushed 8/	1,330,000	7,180,000	1,420,000	8,050,000 r/	1,500,000	8,800,000
Tripoli metric tons	79,600	18,400	81,300	16,400	NA	NA
Zeolites do.	39,300	NA	30,100	NA	NA	NA
Combined value of brucite, emery, greensand marl, kyanite, lithium minerals, magnesite, magnesium compounds, olivine, staurolite, stone (dimension), talc and pyrophyllite, wollastonite, and values indicated by symbol W	XX	820,000	XX	803,000	XX	1,030,000
Total industrial minerals	XX	25,800,000	XX	27,400,000	XX	28,800,000
Grand total	XX	38,800,000	XX	40,500,000	XX	40,000,000

e/ Estimated. p/ Preliminary. NA Not available. W Withheld to avoid disclosing company proprietary data; value included with "Combined value." XX Not applicable.

1/ Production as measured by mine shipments, sales, or marketable production (including consumption by producers).

2/ Data are rounded to three significant digits; may not add to totals shown.

3/ Content of ore and concentrate.

4/ Recoverable content of ores, etc.

5/ There was no production at the Nickel Mountain Mine near Riddle, OR, in 1998. The mine has been idle and on a care-and- maintenance basis since 1996 because of low prices for nickel ore. The Glenbrook Nickel Company permanently closed the mine and adjoining smelter on March 31, 1998.

6/ Weight reported as B2O3 and may not be comparable to prior years.

7/ Includes grindstones, pulpstones, and sharpening stones; excludes mill liners and grinding pebbles.

8/ Excludes abrasive stone and bituminous limestone and sandstone; all included elsewhere in table.

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TABLE 2
NONFUEL MINERALS PRODUCED IN THE UNITED STATES, BY COMMODITY AND STATES IN 1998 p/

(Based on quantity unless otherwise noted)

Mineral	Principal States	Other States 1/
Antimony 2/	ID	
Asbestos	CA	
Barite	NV, GA, TN	
Beryllium concentrate	UT	
Boron, B2O3	CA	
Bromine	AR and MI	
Brucite	AZ and NV	
Cement:		
Masonry	IN, FL, AL, SC, PA	AR, AZ, CA, CO, GA, HI, ID, IA, KS, KY, MD, ME, MI, MO, MT, NE, NM, NY, OH, OK, OR, SD, TN, TX, VA, WA, WV.
Portland	CA, TX, PA, MI, MO	All other States except AK, CT, DE, LA, MA, MN, NH, NJ, NC, ND, RI, VT, WI.
Clays:		
Ball	TN, TX, KY, MS, MO	
Bentonite	WY, AL, MT, MS, UT	AZ, CA, NV, OR, TX.
Common	AL, NC, TX, GA, OH	All other States except AK, DE, HI, ID, NV, NH, RI, VT, WI.
Fire	OH, MO, AL, CA, NM	
Fuller's earth	GA, MS, FL, MO, IL	CA, KS, NV, OR, TX, VA.
Kaolin	GA, SC, AL, AR, CA	FL, NV, NC, PA, TX.
Copper 2/	AZ, UT, NM, NV, MT	AK, ID, MO.
Diatomite	CA, NV, OR, WA	
Emery	OR	
Feldspar	NC, CA, VA, GA, OK	ID and SD.
Garnet, industrial	ID, NY, MT	
Gemstones, natural 3/	TN, AZ, NV, CA, OR	All other States.
Gold 2/	NV, CA, AK, SD, UT	AZ, CO, ID, MT, NM, SC, WA.
Greensand marl	NJ and TX	
Gypsum, crude	OK, TX, IA, MI, CA	AR, AZ, CO, IN, KS, LA, NM, NV, NY, OH, SD, UT, VA, WY.
Helium:		
Crude	KS, TX, OK	
Grade-A	KS, WY, TX, OK, UT	CO.
Iodine	OK	
Iron ore, usable	MN, MI, MO, NM, SD	CA and MT.
Iron oxide pigments, crude	MI, MO, GA, AL, VA	AZ.
Kyanite	VA	
Lead 2/	MO, AK, ID, MT, CO	NY and TN.
Lime	MO, OH, KY, AL, PA	All other States except AK, CT, DE, FL, HI, KS, MD, ME, MS, NC, NH, NJ, NM, NY, RI, SC, VT.
Lithium minerals	NV and NC	
Magnesite	NV	
Magnesium compounds	MI, CA, UT, FL, DE	TX.
Magnesium metal	TX, UT, WA	
Manganiferous ore	SC	
Mercury	NV, CA, UT	
Mica, crude	NC, GA, NM, SC, SD	
Molybdenum	AZ, CO, ID, UT, MT	NM.
Olivine	WA and NC	
Palladium metal	MT	
Peat	FL, MI, IL, MN, NJ	CO, IN, IA, ME, MT, NC, NJ, NY, OH, PA, WA, WI, WV.
Perlite	NM, AZ, CA, OR, UT	
Phosphate rock	FL, NC, ID, UT	
Platinum metal	MT	
Potash, K2O	NM, UT, MI	
Pumice and pumicite	OR, NM, ID, CA, AZ	KS.
Rare-earth metal concentrates	CA	
Salt	LA, TX, NY, KS, OH	AL, AZ, CA, MI, NM, NV, OK, TN, UT, WV.
Sand and gravel:		
Construction	CA, TX, MI, OH, AZ	All other States.
Industrial	IL, MI, CA, TX, WI	All other States except AK, CT, DE, HI, KY, ME, MT, NH, NM, OR, SD, UT, VT, WY.
Silica stone 4/	WI, AR, OH	
Silver 2/	NV, AK, ID, AZ, UT	CA, CO, MO, MT, NM, NY, SC, SD, TN, WA, WI.
Sodium compounds:		
Soda ash	WY and CA	
Sodium sulfate, natural	CA and TX	

See footnotes at end of table.

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TABLE 2--Continued
NONFUEL MINERALS PRODUCED IN THE UNITED STATES, BY COMMODITY AND STATES IN 1998 p/

(Based on quantity unless otherwise noted)

Mineral	Principal States	Other States 1/
Staurolite	FL	
Stone:		
Crushed	TX, PA, FL, OH, MO	All other States, except DE and ND.
Dimension	IN, VT, WI, PA, MA	All other States except AK, DE, FL, HI, IA, IL, KY, LA, MS, ND, NE, NJ, NV, OR, RI, UT, WY.
Sulfur, Frasch	LA and TX	
Talc and pyrophyllite	MT, TX, VT, NY, NC	CA, OR, VA.
Titanium concentrates:		
Ilmenite	FL, CA, VA	
Rutile	FL	
Tripoli	OK, PA, IL, AR	
Vanadium 2/	ID	
Vermiculite, crude	VA and SC	
Wollastonite	NY	
Zinc 2/	AK, TN, NY, MO, MT	CO, ID.
Zirconium concentrates	FL and VA	

p/ Preliminary.
1/ States listed in alphabetical order.
2/ Content of ores, etc.
3/ Principal producing States based on value.
4/ Includes grindstones, pulpstones, and sharpening stones; excludes mill liners and grinding pebbles.

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TABLE 3

VALUE OF NONFUEL MINERAL PRODUCTION IN THE UNITED STATES AND PRINCIPAL NONFUEL MINERALS PRODUCED IN 1998 p/ 1/

State	Value (thousands)	Rank	Percent of U.S. total	Principal minerals, in order of value
Alabama	$947,000	15	2.37	Cement (portland), stone (crushed), lime, sand and gravel (construction), cement (masonry).
Alaska	911,000	16	2.28	Zinc, gold, lead, silver, sand and gravel (construction).
Arizona	2,820,000	3	7.05	Copper, sand and gravel (construction), cement (portland), molybdenum, stone (crushed).
Arkansas	598,000	24	1.49	Stone (crushed), bromine, cement (portland), sand and gravel (construction), sand and gravel (industrial).
California	2,970,000	2	7.42	Sand and gravel (construction), cement (portland), boron (B2O3), stone (crushed), gold.
Colorado	604,000	23	1.51	Sand and gravel (construction), cement (portland), molybdenum, stone (crushed), gold.
Connecticut 2/	105,000	43	0.26	Stone (crushed), sand and gravel (construction), stone (dimension), clays (common), gemstones.
Delaware 2/	11,200	50	0.03	Sand and gravel (construction), magnesium compounds, gemstones.
Florida	1,960,000	4	4.90	Phosphate rock, stone (crushed), cement (portland), sand and gravel (construction), zirconium concentrates.
Georgia	1,790,000	6	4.48	Clays (kaolin), stone (crushed), cement (portland), clays (fuller's earth), sand and gravel (construction).
Hawaii	85,500	45	0.21	Stone (crushed), cement (portland), sand and gravel (construction), cement (masonry), gemstones.
Idaho	444,000	31	1.11	Phosphates rock, molybdenum, silver, gold, sand and gravel (construction).
Illinois	862,000	17	2.15	Stone (crushed), cement (portland), sand and gravel (construction), sand and gravel (industrial), lime.
Indiana	700,000	21	1.75	Stone (crushed), cement (portland), sand and gravel (construction), lime, cement (masonry).
Iowa	524,000	28	1.31	Stone (crushed), cement (portland), sand and gravel (construction), gypsum (crude), lime.
Kansas	535,000	27	1.34	Cement (portland), salt, helium (Grade-A), stone (crushed), helium (crude).
Kentucky	489,000	30	1.22	Stone (crushed), lime, cement (portland), sand and gravel (construction), clays (ball).
Louisiana	379,000	33	0.95	Salt, sulfur (Frasch), sand and gravel (construction), stone (crushed), sand and gravel (industrial).
Maine	76,200	46	0.19	Sand and gravel (construction), cement (portland), stone (crushed), peat, cement (masonry).
Maryland	358,000	34	0.89	Stone (crushed), cement (portland), sand and gravel (construction), cement (masonry), stone (dimension).
Massachusetts	192,000	39	0.48	Stone (crushed), sand and gravel (construction), stone (dimension), lime, clays (common).
Michigan	1,750,000	7	4.36	Iron ore (usable), cement (portland), sand and gravel (construction), magnesium compounds, stone (crushed
Minnesota	1,730,000	8	4.32	Iron ore (usable), sand and gravel (construction), stone (crushed), stone (dimension), sand and gravel (industrial).
Mississippi	190,000	40	0.47	Sand and gravel (construction), cement (portland), clays (fuller's earth), stone (crushed), sand and gravel (industrial).
Missouri	1,360,000	9	3.39	Stone (crushed), cement (portland), lead, lime, zinc.
Montana	500,000	29	1.25	Copper, gold, palladium, cement (portland), molybdenum.
Nebraska	174,000	42	0.43	Cement (portland), sand and gravel (construction), stone (crushed), lime, cement (masonry).
Nevada	3,100,000	1	7.73	Gold, silver, copper, sand and gravel (construction), lime.
New Hampshire 2/	53,100	47	0.13	Sand and gravel (construction), stone (crushed), stone (dimension), gemstones.
New Jersey 2/	301,000	35	0.75	Stone (crushed), sand and gravel (construction), sand and gravel (industrial), greensand marl, peat.
New Mexico	860,000	18	2.15	Copper, potash (K2O), sand and gravel (construction), cement (portland), stone (crushed).
New York	983,000	14	2.46	Stone (crushed), cement (portland), sand and gravel (construction), salt, zinc.
North Carolina	785,000	19	1.96	Stone (crushed), phosphate rock, sand and gravel (construction), sand gravel (industrial), feldspar.
North Dakota	34,700	48	0.09	Sand and gravel (construction), lime, sand and gravel (industrial), clays (common), gemstones.
Ohio	1,150,000	12	2.88	Stone (crushed), sand and gravel (construction), salt, lime, cement (portland).
Oklahoma	408,000	32	1.02	Cement (portland), stone (crushed), sand and gravel (construction), sand and gravel (industrial), iodine.
Oregon	272,000	37	0.68	Stone (crushed), sand and gravel (construction), cement (portland), diatomite, lime.
Pennsylvania	1,280,000	11	3.20	Stone (crushed), cement (portland), sand and gravel (construction), lime, cement (masonry).
Rhode Island 2/	27,800	49	0.07	Sand and gravel (construction), stone (crushed), sand and gravel (industrial), gemstones.
South Carolina	589,000	25	1.47	Stone (crushed), cement (portland), cement (masonry), sand and gravel (construction), gold.
South Dakota	269,000	38	0.67	Gold, cement (portland), sand and gravel (construction), stone (crushed), stone (dimension).
Tennessee	709,000	20	1.77	Stone (crushed), zinc, cement (portland), sand and gravel (construction), clays (ball).
Texas	1,920,000	5	4.81	Cement (portland), stone (crushed), sand and gravel (construction), magnesium metal, lime.
Utah	1,300,000	10	3.25	Copper, sand and gravel (construction), magnesium metal, gold, cement (portland).
Vermont 2/	96,000	44	0.24	Stone (crushed), stone (dimension), sand and gravel (construction), talc and pyrophyllite, gemstones.
Virginia	679,000	22	1.70	Stone (crushed), cement (portland), sand and gravel (construction), lime, clays (fuller's earth).
Washington	583,000	26	1.46	Sand and gravel (construction), magnesium metal, cement (portland), stone (crushed), gold.
West Virginia	182,000	41	0.46	Stone (crushed), cement (portland), sand and gravel (industrial), lime, salt.
Wisconsin 2/	296,000	36	0.74	Stone (crushed), sand and gravel (construction), lime, sand and gravel (industrial), stone (dimension).
Wyoming	1,060,000	13	2.65	Soda ash, clays (bentonite), helium (Grade-A), cement (portland), stone (crushed).
Undistributed	30,500	XX	0.08	
Total	40,000,000	XX	100.00	

p/ Preliminary. XX Not applicable.

1/ Data are rounded to three significant digits; may not add to totals shown.

2/ Partial total; excludes values that must be concealed to avoid disclosing company proprietary data. Concealed values included with "Undistributed."

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TABLE 4

VALUE OF NONFUEL MINERAL PRODUCTION PER CAPITA AND PER SQUARE KILOMETER IN 1998 , BY STATE p/ 1/

State	Area (square kilometers)	Population (thousands)	Total value (thousands)	Per capita		Per square kilometer	
				Dollars	Rank	Dollars	Rank
Alabama	134,000	4,320	$947,000	219	14	7,070	19
Alaska	1,530,000	609	911,000	1,500	3	595	49
Arizona	295,000	4,550	2,820,000	620	5	9,560	9
Arkansas	138,000	2,520	598,000	237	13	4,340	27
California	411,000	32,300	2,970,000	92	34	7,230	18
Colorado	270,000	3,890	604,000	155	20	2,240	38
Connecticut	13,000	3,270	105,000 2/	32	47	8,060	12
Delaware	5,290	732	11,200 2/	15	50	2,120	40
Florida	152,000	14,700	1,960,000	134	21	12,900	3
Georgia	153,000	7,490	1,790,000	240	12	11,800	4
Hawaii	16,800	1,190	85,500	72	38	5,100	25
Idaho	216,000	1,210	444,000	367	9	2,050	41
Illinois	146,000	11,900	862,000	73	37	5,910	23
Indiana	93,700	5,860	700,000	119	25	7,470	16
Iowa	146,000	2,850	524,000	184	16	3,600	30
Kansas	213,000	2,590	535,000	206	15	2,510	36
Kentucky	105,000	3,910	489,000	125	23	4,670	26
Louisiana	124,000	4,350	379,000	87	35	3,060	32
Maine	86,200	1,240	76,200	61	41	884	47
Maryland	27,100	5,090	358,000	70	39	13,200	2
Massachusetts	21,500	6,120	192,000	31	48	8,960	10
Michigan	152,000	9,770	1,750,000	179	17	11,500	5
Minnesota	219,000	4,690	1,730,000	369	8	7,910	13
Mississippi	124,000	2,730	190,000	69	40	1,530	43
Missouri	181,000	5,400	1,360,000	251	11	7,510	15
Montana	381,000	879	500,000	569	6	1,310	45
Nebraska	200,000	1,660	174,000	105	28	868	48
Nevada	286,000	1,680	3,100,000	1,850	2	10,800	7
New Hampshire	24,000	1,170	53,100 2/	45	45	2,210	39
New Jersey	20,200	8,050	301,000 2/	37	46	14,900	1
New Mexico	315,000	1,730	860,000	497	7	2,730	35
New York	127,000	18,100	983,000	54	43	7,730	14
North Carolina	136,000	7,430	785,000	106	27	5,750	24
North Dakota	183,000	641	34,700	54	44	189	50
Ohio	107,000	11,200	1,150,000	103	30	10,800	8
Oklahoma	181,000	3,320	408,000	123	24	2,250	37
Oregon	251,000	3,240	272,000	84	36	1,080	46
Pennsylvania	117,000	12,000	1,280,000	107	26	10,900	6
Rhode Island	3,140	987	27,800 2/	28	49	8,860	11
South Carolina	80,600	3,760	589,000	157	19	7,310	17
South Dakota	200,000	738	269,000	365	10	1,350	44
Tennessee	109,000	5,370	709,000	132	22	6,490	20
Texas	691,000	19,400	1,920,000	99	33	2,790	34
Utah	220,000	2,060	1,300,000	633	4	5,930	22
Vermont	24,900	589	96,000 2/	163	18	3,860	29
Virginia	106,000	6,730	679,000	101	31	6,430	21
Washington	176,000	5,610	583,000	104	29	3,300	31
West Virginia	62,800	1,820	182,000	100	32	2,910	33
Wisconsin	145,000	5,170	296,000 2/	57	42	2,040	42
Wyoming	253,000	480	1,060,000	2,210	1	4,190	28
Undistributed	XX	XX	30,500	XX	XX	XX	XX
Total or average	9,370,000 3/	267,000 3/	40,000,000	150	XX	4,270	XX

p/ Preliminary. XX Not applicable.

1/ Data are rounded to three significant digits; may not add to totals shown.

2/ Partial total; excludes values that must be concealed to avoid disclosing company proprietary data. Concealed values included with "Undistributed."

3/ Excludes Washington, DC (which has no mineral production), with an area of 179 square kilometers and a population of 529,000.

Sources: U.S. Geological Survey and Bureau of the Census.

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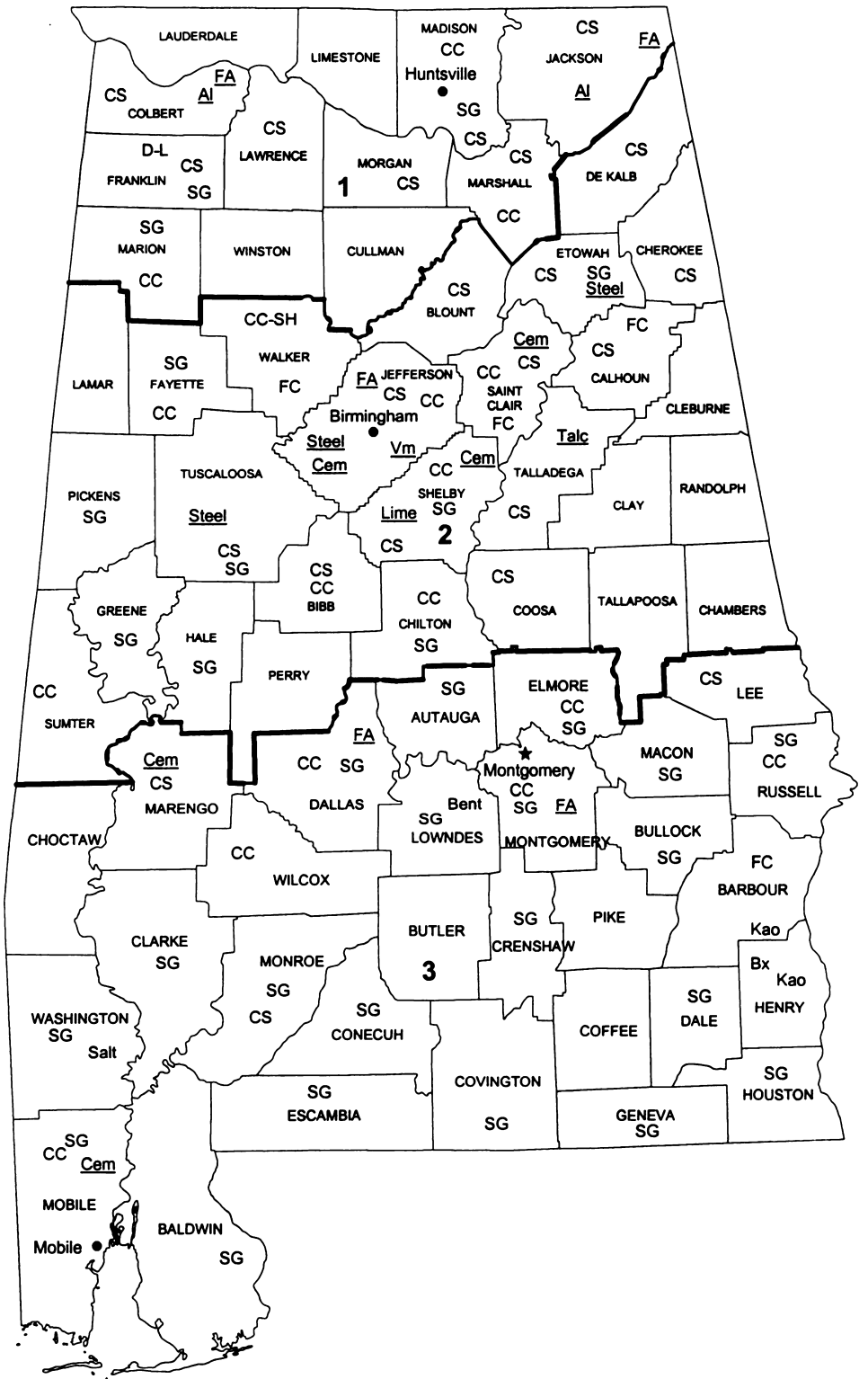
ALABAMA



LEGEND

- County boundary
- ★ Capital
- ● City
- 1 Crushed stone/sand and gravel districts

MINERAL SYMBOLS
(Major producing areas)

Al	Aluminum plant
Bent	Bentonite
Bx	Bauxite
CC	Common clay
CC-Sh	Common clay and shale
Cem	Cement plant
CS	Crushed stone
D-L	Dimension limestone
FA	Ferroalloys plant
FC	Fire clay
Ka	Kaolin
Lime	Lime plant
Salt	Salt
SG	Sand and gravel
Sh	Shale
Steel	Iron and steel plant
Talc	Talc plant
Vm	Vermiculite plant

0 50 Kilometers

Source: Geological Survey of Alabama/U.S. Geological Survey (1998)

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THE MINERAL INDUSTRY OF ALABAMA

This chapter has been prepared under a Memorandum of Understanding between the U.S. Geological Survey and the Geological Survey of Alabama for collecting information on all nonfuel minerals.

In 1998, the preliminary estimated value[1] of nonfuel mineral production for Alabama was $947 million, according to the U.S. Geological Survey (USGS). This was a more than 7% increase from that of 1997,[2] following a 13.2% increase from 1996 to 1997. The State rose in rank to 16th from 17th among the 50 States in total nonfuel mineral production value, of which Alabama accounted for almost 2.5% of the U.S. total.

The top four nonfuel mineral commodities produced in Alabama in 1998 were, in descending order of value, portland cement, crushed stone, lime, and construction sand and gravel; they accounted for 90% of the State's total nonfuel mineral production value. The combined value of crushed stone and portland cement represented 71% of the total. Of the State's overall increase in value from 1997 to 1998, 53% of it resulted from the $35 million increase in crushed stone and 30% was accounted for by the $20 million rise in portland cement (table 1). Construction sand and gravel increased by about $7 million. Most other nonfuel minerals increased in value, except for gemstones, which had a small decrease; the values of kaolin, crude iron oxide pigments, and salt virtually remained the same. In 1997, the most significant increases were the $75 million rise in crushed stone and the $18 million increase in portland cement (table 1).

Nonfuel mineral production in Alabama consisted entirely of industrial minerals; no metals were mined in the State. Compared with USGS estimates of the quantities produced in the other 49 States in 1998, Alabama remained first[2] in common clays, third in masonry cement and kaolin, fourth in lime and iron oxide pigments, sixth in portland cement, and eighth in salt. The State rose to second from third in the production of bentonite and to third from fourth in fire clays. Additionally, Alabama's stone quarries and sand pits produced substantial quantities of crushed stone and construction and industrial sand and gravel. All metal production in the State, especially that of raw steel, was the result of processing materials acquired from other domestic and foreign sources. Bauxite is no longer mined in Alabama to produce primary aluminum. Production of a natural mixture of bauxite and bauxitic clay with a very low iron oxide content has been reported to the USGS since 1995 as kaolin; it is primarily used to make refractory (high-temperature-resistant) products.

The Geological Survey of Alabama[3] provided the narrative information that follows. In Alabama, 155 companies or operations were involved in the mining and production of industrial minerals, which included crushed stone, sand, gravel, bentonite, fuller's earth, fire clay, kaolin, common clay, marl, shale, bauxitic clay, building stone, calcium carbonate, recovered sulfur, and salt (solution mining).

The State's crushed stone production included a variety of rock types—limestone, dolomite, marble, sandstone, granite, and quartzite. Record production of 34.5 million metric tons of limestone and dolomite was recorded in 1997 (final data for 1998 are not yet available). Shelby County, the leading limestone-producing area in the State, has had an average annual production of 6.4 million metric tons since 1970, representing roughly 30% of the entire production in Alabama. Shelby County is expected to continue to be the leading stone producing area of the State.

The limestones and dolomites of Alabama have a wide variety of chemical and physical properties suitable for various applications. Limestones of varying grades are used for aggregates, dimension stone, flux, and soil conditioners, and in many industrial processes, including the manufacture of abrasives, cement, chemicals, fillers, glass, lime, and refractories.

Marble production from Sylacauga in Talladega County reached a record of 1.6 million metric tons in 1997. This trend of increasing production, which has been maintained since 1990, is expected to continue past 2000, owing to the economic applications of micronized marble. It is shipped as a slurry and is used in paper pigment and coating and numerous other diverse applications.

Mineral exploration in Alabama continued to focus on industrial resources with several large expansions and new operations in recent years. Vulcan Materials Co.'s new Tuscaloosa quarry recently began operation near Vance to meet demand for crushed stone in a high-growth area (Nicholson, 1997). Opelika Materials LLC recently began crushed stone operations at the historic Chewacla marble quarry in Lee County (Stevenson, 1997). McCartney Construction Co. recently open its Coldwater Mountain quarry near Anniston, producing crushed quartzite for aggregate. ECC International has made a $6 million expansion of its micronized calcium carbonate operation in Sylacauga.

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[1]The terms "nonfuel mineral production" and related "values" encompass variations in meaning, depending on the minerals or mineral products. Production may be measured by mine shipments, mineral commodity sales, or marketable production (including consumption by producers) as is applicable to the individual mineral commodity.

All 1998 USGS mineral production data published in this chapter are preliminary estimates as of February 1999 and are expected to change. For some mineral commodities (for example, construction sand and gravel, crushed stone, and portland cement), estimates are updated periodically. To obtain the most current information, please contact the appropriate USGS mineral commodity specialist. A telephone listing for the specialists may be retrieved over the Internet at http://minerals.usgs.gov/minerals/contacts/comdir.html; by using MINES FaxBack at (703) 648-4999 from a fax machine with a touch-tone handset (request Document #1000 for a telephone listing of all mineral commodity specialists); or by calling USGS information at (703) 648-4000 for the specialist's name and number. All Mineral Industry Surveys–mineral commodity, State, and country–also may be retrieved over the Internet at http://minerals.usgs.gov/minerals; facsimile copies may be obtained from MINES FaxBack.

[2]Values, percentage calculations, and rankings for 1997 may vary from the *Minerals Yearbook, Area Reports: Domestic 1997, Volume II*, owing to the revision of preliminary 1997 to final 1997 data. Data for 1998 are preliminary and expected to change, while related rankings may also be subject to change.

[3]Lewis S. Dean, a Geologist at the Geological Survey of Alabama, authored the text of State minerals information provided by that agency.

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Clanton Classic Stone continued development of a new building stone operation from a varicolored "marble" (polished limestone) in Lauderdale County (Adams, 1998). Other expanding mineral industries include refractory clay products in Calhoun County and limestone production in Jefferson County. Duke Energy announced an $88 million petroleum refining and natural gas cleansing plant in Mobile (Alabama Development Office, 1997).

Sand and gravel production has come primarily from deposits in the Montgomery district. Other large producing areas of the State are Tuscaloosa, Russell, and Mobile Counties. In the past, small plants alone produced sand and gravel for a specific job or area. Recently the trend has been to develop large, high-capacity plants using long-distance transportation. Although many of the plants are small, they are designed to produce large quantities of material.

The Geological Survey of Alabama published its annual minerals industry summary that provides details of the occurrence, mining history, and general economics of specific mineral resources in Alabama. More information on geology, hydrology, and environmental considerations related to these resources is available from the Geological Survey of Alabama.

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TABLE 1
NONFUEL RAW MINERAL PRODUCTION IN ALABAMA 1/ 2/

(Thousand metric tons and thousand dollars unless otherwise specified)

Mineral	1996 Quantity	1996 Value	1997 Quantity	1997 Value	1998 p/ Quantity	1998 p/ Value
Cement:						
Masonry	309	32,000 e/	346	36,200 e/	352	38,000
Portland	4,330	326,000 e/	4,280	344,000 e/	4,430	364,000
Clays:						
Bentonite	166	5,060	W	W	W	W
Common	2,290	17,100	2,590	25,400	2,640	25,900
Fire	52	2,800	W	W	W	W
Kaolin	254	W	W	W	W	W
Gemstones	NA	2,000	NA	860	NA	175
Lime	1,860	116,000	1,830	115,000	1,900	116,000
Sand and gravel:						
Construction	13,800	60,600	13,400	58,800	14,500	65,600
Industrial	799	8,380	734	9,730	745	9,900
Stone: Crushed	38,900	198,000	42,000	273,000	45,600	308,000
Combined values of iron oxide pigments [crude, (1997-98)], salt, stone (dimension limestone and sandstone), and values indicated by symbol W	XX	9,930	XX	17,600	XX	20,200
Total	XX	778,000	XX	881,000	XX	947,000

e/ Estimated. p/ Preliminary. NA Not available. W Withheld to avoid disclosing company proprietary data; value included with "Combined values" data. XX Not applicable.
1/ Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
2/ Data are rounded to three significant digits; may not add to totals shown.

TABLE 2
ALABAMA: CRUSHED STONE SOLD OR USED, BY KIND 1/

Kind	1996 Number of quarries	1996 Quantity (thousand metric tons)	1996 Value (thousands)	1996 Unit value	1997 Number of quarries	1997 Quantity (thousand metric tons)	1997 Value (thousands)	1997 Unit value
Limestone 2/	43	34,400 r/	$167,000 r/	$4.85 r/	45	37,300	$194,000	$5.21
Dolomite	3	W	W	5.34	3	W	W	5.47
Marble	2 r/	W	W	10.55 r/	2	W	W	35.38
Granite	4 r/	W	W	3.36 r/	4	W	W	5.46
Slate	2	W	W	3.46	1	W	W	5.17
Total	XX	38,900	198,000	5.09	XX	42,000	273,000	6.51

r/ Revised. W Withheld to avoid disclosing company proprietary data; included in "Total." XX Not applicable.
1/ Data are rounded to three significant digits, except unit value; may not add to totals shown.
2/ Includes limestone-dolomite reported with no distinction between the two.

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TABLE 3
ALABAMA: CRUSHED STONE SOLD OR USED BY PRODUCERS
IN 1997, BY USE 1/

Use	Quantity (thousand metric tons)	Value (thousands)	Unit value
Coarse aggregate (+1 1/2 inch) 2/	752	$4,990	$6.64
Coarse aggregate, graded:			
Concrete aggregate, coarse	2,450	12,900	5.27
Bituminous aggregate, coarse	4,210	22,500	5.35
Bituminous surface-treatment aggregate	612	3,320	5.42
Other graded coarse aggregate 3/	438	3,380	7.73
Fine aggregate (-3/8 inch):			
Stone sand, concrete	555	2,950	5.31
Stone sand, bituminous mix or seal	1,820	9,450	5.20
Screening, undesignated	136	682	5.01
Other fine aggregate	40	248	6.20
Coarse and fine aggregates:			
Graded road base or subbase	3,680	18,400	5.00
Unpaved road surfacing	27	150	5.56
Crusher run or fill or waste	2,790	15,900	5.71
Other coarse and fine aggregates	387	4,630	11.97
Other construction materials	260	1,450	5.57
Agricultural:			
Agricultural limestone	216	1,150	5.31
Other agricultural uses 4/	147	2,110	14.37
Chemical and metallurgical:			
Cement manufacture	3,080	9,320	3.03
Lime manufacture	1,600	7,390	4.63
Special:			
Whiting or whiting substitute	650	35,800	55.08
Other fillers or extenders	217	11,900	54.99
Unspecified: 5/			
Actual	12,400	73,500	5.93
Estimated	5,530	31,000	5.60
Total	42,000	273,000	6.51

1/ Data are rounded to three significant digits, except unit value; may not add to totals shown.
2/ Includes filter stone, macadam, other coarse aggregate, and riprap and jetty stone.
3/ Includes railroad ballast.
4/ Includes poultry grit and mineral food.
5/ Includes reported and estimated production without a breakdown by end use.

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TABLE 4
ALABAMA: CRUSHED STONE SOLD OR USED BY PRODUCERS IN 1997,
BY USE AND DISTRICT 1/

Use	District 1		District 2		District 3	
	Quantity (metric tons)	Value (thousands)	Quantity (metric tons)	Value (thousands)	Quantity (metric tons)	Value (thousands)
Construction aggregates:						
Coarse aggregate (+1 1/2 inch) 2/	389	$2,450	W	W	W	W
Coarse aggregate, graded 3/	W	W	W	W	W	W
Fine aggregate (-3/8 inch) 4/	W	W	W	W	W	W
Coarse and fine aggregate 5/	W	W	W	W	W	W
Other construction materials	8,650	45,500	8,570	$46,100	527	$6,930
Agricultural 6/	186	1,020	176	2,240	--	--
Chemical and metallurgical 7/	--	--	3,350	12,500	(8/)	(8/)
Special 9/	--	--	866	47,700	--	--
Unspecified 10/						
Actual	(8/)	(8/)	9,650	60,600	(8/)	(8/)
Estimated	378	1,930	5,160	29,100	--	--
Total	10,900	55,600	27,800	198,000	3,340	19,400

W Withheld to avoid disclosing company proprietary data; included with "Other construction materials."
1/ Data are rounded to three significant digits; may not add to totals shown.
2/ Includes, macadam, riprap and jetty stone, and other coarse aggregate.
3/ Includes concrete aggregate (coarse), bituminous aggregate (coarse), bituminous surface-treatment aggregate, railroad ballast and other coarse aggregates.
4/ Includes stone sand (concrete), stone sand (bituminous mix or seal), screening (undesignated), and other fine aggregate.
5/ Includes graded road base or subbase, unpaved road surfacing, terrazzo and exposed aggregate, and crusher run (select material or fill).
6/ Includes agricultural limestone, poultry grit and mineral food, and other agricultural uses.
7/ Includes cement manufacture, lime manufacture, and flux stone.
8/ Withheld to avoid disclosing company proprietary data; included in "Total."
9/ Includes whiting or whiting substitute and other fillers or extenders.
10/ Includes reported and estimated production without a breakdown by end use.

TABLE 5
ALABAMA: CONSTRUCTION SAND AND GRAVEL SOLD OR USED IN 1997,
BY MAJOR USE CATEGORY 1/

Use	Quantity (thousand metric tons)	Value (thousands)	Value per ton
Concrete aggregate (including concrete sand) 2/	4,610	$17,900	$3.88
Concrete products (blocks, bricks, pipe, decorative, etc.)	268	1,760	6.58
Asphaltic concrete aggregates and other bituminous mixtures 3/	637	3,920	6.16
Road base and coverings 4/	779	3,180	4.08
Fill	359	851	2.37
Filtration	11	50	4.55
Unspecified: 5/			
Actual	4,000	19,300	4.83
Estimated	2,780	11,900	4.28
Total or average	13,400	58,800	4.38

1/ Data are rounded to three significant digits; may not add to totals shown.
2/ Includes plaster and gunite sands.
3/ Includes snow and ice control.
4/ Includes road and other stabilization (lime).
5/ Includes reported and estimated production without a breakdown by end use.

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TABLE 6

ALABAMA: CONSTRUCTION SAND AND GRAVEL SOLD OR USED IN 1997, BY USE AND DISTRICT 1/

(Thousand metric tons and thousand dollars)

Use	District 1		District 2		District 3	
	Quantity	Value	Quantity	Value	Quantity	Value
Concrete aggregate and concrete products 2/	557	2,880	668	2,780	3,660	14,000
Asphaltic concrete aggregates 3/	W	W	369	1,740	W	W
Road base and coverings 4/	--	--	132	650	647	2,530
Filtration	11	50	--	--	--	--
Unspecified: 5/						
Actual	W	W	366	2,330	W	W
Estimated	272	740	344	926	2,160	10,200
Total	1,440	6,110	1,880	8,430	10,100	44,300

W Withheld to avoid disclosing company proprietary data; included in "Total."
1/ Data are rounded to three significant digits; may not add to totals shown.
2/ Includes plaster and gunite sands.
3/ Includes snow and ice control.
4/ Includes road and other stabilization (lime).
5/ Includes reported and estimated production without a breakdown by end use.

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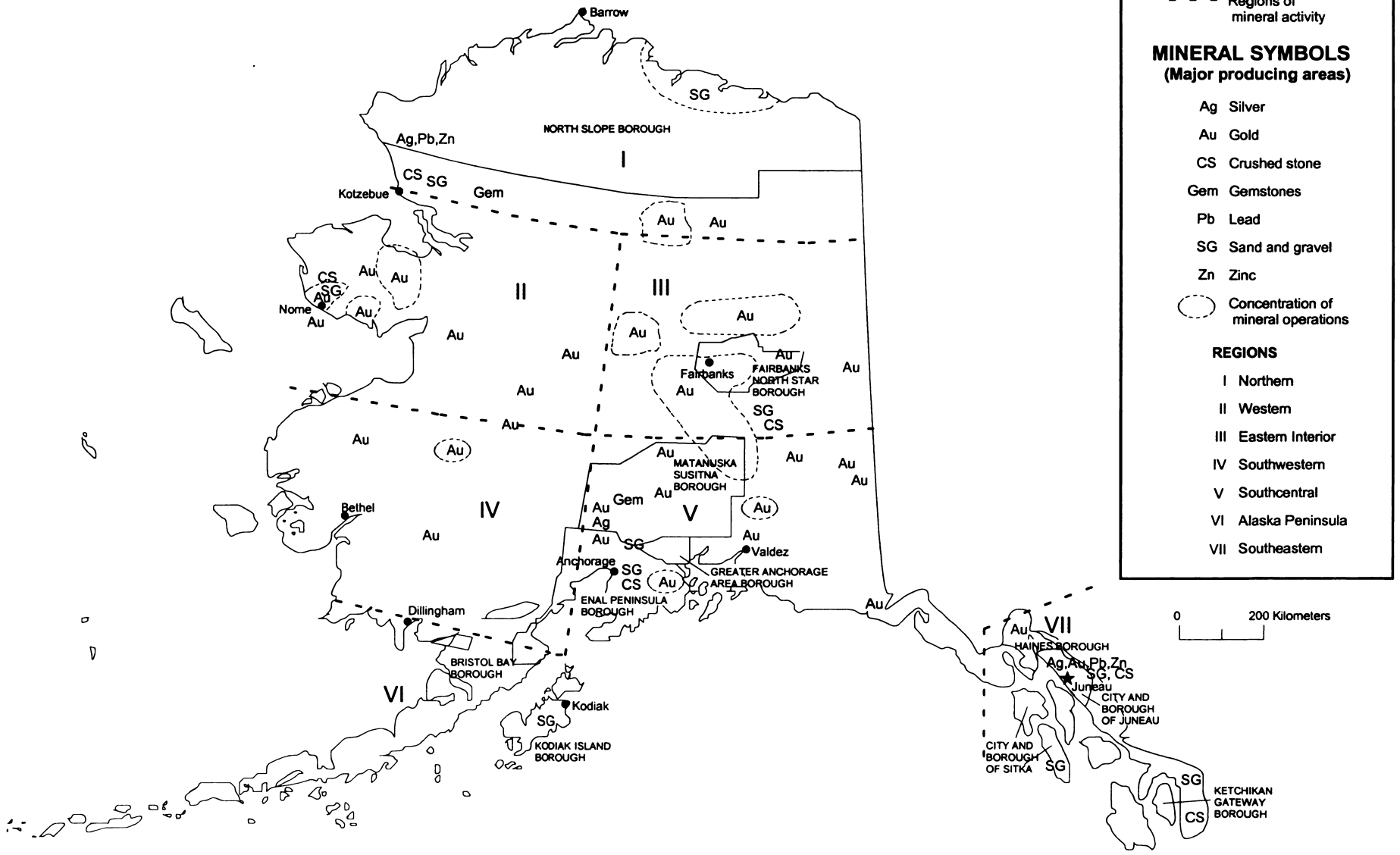
ALASKA



Source: Alaska Division of Geological and Geophysical Surveys/U.S. Geological Survey (1998)

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THE MINERAL INDUSTRY OF ALASKA

In 1998, the preliminary estimated value[1] of nonfuel mineral production for Alaska was $911 million, according to the U.S. Geological Survey (USGS). This was about a 7% decrease from that of 1997,[2] following a 60% increase from 1996 to 1997. The State decreased in rank in 1998 from 15th to 16th among the 50 States in total nonfuel mineral production value, of which Alaska accounted for more than 2% of the U.S. total.

Overall, metallic minerals accounted for more than 91% of the State's total nonfuel mineral production value in 1998. A large majority of this was from zinc, lead, and silver production at the Red Dog Mine in northwestern Alaska and gold from the Fort Knox Mine near Fairbanks in east central Alaska. (Listings of mineral commodities are in descending order of value, magnitude of change in value, or quantity produced.) In 1998, the estimated values for most of the State's commodities showed decreases except for silver, which had a small increase, and construction sand and gravel and gemstones, which remained the same. The largest portion of the decline resulted from a $34 million drop in the value of gold and a nearly $30 million drop in zinc. In 1997, increases in the production and values of zinc, gold, silver, and construction sand and gravel (in descending order of increase) accounted for most of the State' s substantial rise in value (table 1). Smaller yet significant increases also occurred in lead and crushed stone.

Based on USGS estimates of the quantities produced in the 50 States during 1998, Alaska remained first[2] in zinc, second in lead and silver, and rose to third from fourth in the production of gold.[3] Production of peat was not reported to the USGS, in part, because of reporting difficulties associated with the seasonal, intermittent nature of the mineral commodity's mining in the State. The Alaska Department of Natural Resources Division of Geological and Geophysical Surveys (DGGS) estimated peat production to be about 29,100 cubic meters for a estimated value of about $190,000. Additionally, DGGS reported production of jade and soapstone of about 1.8 metric tons at an estimated value of $25,000 (Szumigala and Swainbank, 1999).

The DGGS provided the following narrative information; the data are based on DGGS surveys and estimates (Szumigala and Swainbank, 1999). Highlights for 1998 were increased production of lead, zinc, and silver from the Red Dog Mine near Kotzebue. Red Dog continues to be the world's largest producer of zinc. Greens Creek Mine near Juneau remained one of the largest producers of silver in the United States and continues to produce significant lead, zinc, copper, and gold. Fort Knox Mine near Fairbanks was Alaska's largest gold producer, and there was continued gold production from Nixon Fork Mine, Illinois Creek Mine, and several dozen placer mines distributed throughout Alaska. Sealaska Corp. began production of high-grade calcium carbonate, suitable for high-quality paper coating and paint, from Calder Mine on Prince of Wales Island.

Development expenditures dropped sharply from $167 million in 1997 to $55 million in 1998. Red Dog Mine completed its Production Rate Increase project in September. Fort Knox Mine added a semiautogenous grinding crusher and a number of in-pit projects. Greens Creek Mine continued development work to access its Southwest Orebody. Development work was completed at Calder Mine and the mine was brought into operation in August. Ongoing development work continued at numerous placer mines.

Exploration expenditures in Alaska during 1998 were $56 million, down only 2% from 1997 levels, despite historically low metal prices and massive reduction in worldwide exploration budgets. Sixty-four percent of expenditures were spent in the eastern interior region of Alaska, sparked by continued exciting results from the Pogo property, continued exploration programs in the Fairbanks mining district, and renewed interest in the polymetallic mineral belt on the north flank of the Alaska Range. Significant resource calculations announced for several properties in the eastern interior region include 162,000 kilograms of gold at the Pogo property, 50,000 kilograms of gold at the Golden Summit property, and 2.8 million metric tons of 4.4% zinc, 1.9% lead, 0.2% copper, 93.6 grams per ton of silver, and 0.55 grams per ton gold calculated for the DC North horizon on the Dry Creek property. Gold exploration was also strong in southwestern Alaska, with an announced resource of 358,000 kilograms of gold at the Donlin Creek property and a resource of 31,000 kilograms at the Shotgun property.

In Government actions, DGGS contracted for airborne geophysical surveys conducted in the Fortymile and Livengood

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[1]The terms "nonfuel mineral production" and related "values" encompass variations in meaning, depending on the minerals or mineral products. Production may be measured by mine shipments, mineral commodity sales, or marketable production (including consumption by producers) as is applicable to the individual mineral commodity.

All 1998 USGS mineral production data published in this chapter are preliminary estimates as of February 1999 and are expected to change. For some commodities (for example, construction sand and gravel, crushed stone, and portland cement), estimates are updated periodically. To obtain the most current information, please contact the appropriate USGS mineral commodity specialist. A telephone listing for the specialists may be retrieved over the Internet at http://minerals.usgs.gov/minerals/contacts/comdir.html; by using MINES FaxBack at (703) 648-4999 from a fax machine with a touch-tone handset (request Document #1000 for a telephone listing of all mineral commodity specialists); or by calling USGS information at (703) 648-4000 for the specialist's name and number. All Mineral Industry Surveys–mineral commodity, State, and country–also may be retrieved over the Internet at http://minerals.usgs.gov/minerals; fascimile copies may be obtained from MINES FaxBack.

[2]Values, percentage calculations, and rankings for 1997 may vary from the *Minerals Yearbook, Area Reports: Domestic 1997, Volume II*, owing to the revision of preliminary 1997 to final 1997 data. Data for 1998 are preliminary and expected to change, while related rankings may also be subject to change.

[3]Gold figures in table 1, as reported to the USGS, possibly understate actual production and value. The canvassing of gold placer mineral production was discontinued by the U.S. Bureau of Mines (the Federal agency formerly responsible for U.S. nonfuel mineral production data collection) in 1994. Gold production and value data in table 1 are previous 1996 and 1997 and preliminary 1998 numbers that are estimated by the USGS in cooperation with the Alaska Department of Natural Resources Division of Geological and Geophysical Surveys (DGGS). More recent estimates based on data collected by the DGGS (Szumigala and Swainbank, 1999) indicate estimated production in 1996 to have been 5,030 kilograms at an estimated $62.6 million; in 1997, 18,400 kilograms at an estimated $207 million; and in 1998, 18,300 kilograms at an estimated value of $173 million. The USGS final 1997 and 1998 total gold production and value data for Alaska, also done in collaboration with the DGGS, will be reflected in the upcoming USGS *Mineral Industry Surveys - Gold, 1998 Annual Review*.

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mining districts and released results for airborne geophysical surveys flown in the Ruby, Talkeetna Mountain, Wrangell, and Wiseman areas. DGGS conducted mineral-related field programs in the Petersville and Chulitna areas previously surveyed by airborne geophysics. Greens Creek Mine won first place for underground mines in the Sentinels of Safety Award, and the Fort Knox Mine was second runner up for openpit mines in the same contest. The 1998 Reclamation Award for Excellent Mine Reclamation from the Alaska Department of Natural Resources was awarded to an individual for his work on reclaiming Thistle Creek in the Bonnifield district near Healy. A long-awaited land exchange between Kennecott Minerals Co. and the U.S. Government was completed during 1998 for 3,000 hectares adjacent to Greens Creek Mine.

Reference Cited

Szumigala, D.J. and Swainbank, R.C., 1999, Alaska's Mineral Industry 1998, A Summary: Alaska Department of Natural Resources, Division of Geological and Geophysical Surveys, Information Circular 45, 14 p.

TABLE 1
NONFUEL RAW MINERAL PRODUCTION IN ALASKA 1/ 2/

(Thousand metric tons and thousand dollars unless otherwise specified)

Mineral		1996 Quantity	1996 Value	1997 Quantity	1997 Value	1998 p/ Quantity	1998 p/ Value
Gemstones		NA	11	NA	11	NA	11
Gold 3/ 4/	kilograms	5,020	61,000	18,400 r/	196,000 r/	17,000	162,000
Sand and gravel: Construction		9,380	35,900	12,500	57,400	12,500	57,400
Stone: Crushed 5/		2,600	16,500	3,340	23,500	3,200	22,400
Combined values of copper, lead, silver, stone (crushed dolomite and limestone), zinc		XX	500,000 r/	XX	703,000	XX	670,000
Total		XX	613,000 r/	XX	980,000 r/	XX	911,000

p/ Preliminary. r/ Revised. NA Not available. XX Not applicable.
1/ Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
2/ Data are rounded to three significant digits; may not add to totals shown.
3/ Recoverable content of ores, etc.
4/ Data collected by the State.
5/ Excludes certain stones; kind and value included with "Combined values" data.

TABLE 2
ALASKA: CRUSHED STONE SOLD OR USED, BY KIND 1/ 2/

	1996 Number of quarries	1996 Quantity (thousand metric tons)	1996 Value (thousands)	1996 Unit value	1997 Number of quarries	1997 Quantity (thousand metric tons)	1997 Value (thousands)	1997 Unit value
Limestone-dolomite	1	(3/)	(3/)	(3/)	1	(3/)	(3/)	(3/)
Granite	1	(3/)	(3/)	(3/)	--	--	--	--
Traprock	6	888	$3,300	$3.72	5	663	$2,170	$3.27
Slate	1	7	48	6.86	1	(3/)	(3/)	(3/)
Sandstone	--	--	--	--	1	(3/)	(3/)	(3/)
Miscellaneous stone	6	1,710	13,200	7.72	5	2,670	21,400	8.00
Total	XX	2,600	16,500	6.35	XX	3,340	23,500	7.06

XX Not applicable.
1/ Data derived in part from the Alaska Division of Geological and Geophysical Surveys information.
2/ Data are rounded to three significant digits; may not add to totals shown.
3/ Excluded from State total to avoid disclosing company proprietary data.

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TABLE 3
ALASKA: CRUSHED STONE SOLD OR USED BY PRODUCERS
IN 1997, BY USE 1/ 2/ 3/

Use	Quantity (thousand metric tons)	Value (thousands)	Unit value
Coarse aggregates (+1 inch):			
Riprap and jetty stone	2	$27	$13.50
Filter stone	27	191	7.07
Coarse aggregate, graded:			
Concrete aggregate, coarse	57	233	4.09
Bituminous aggregate, coarse	1	1	1.00
Fine aggregate (-3/8 inch): Screening, undesignated	3	46	15.33
Coarse and fine aggregates:			
Graded road base or subbase	29	153	5.28
Unpaved road surfacing	11	75	6.82
Crusher run or fill or waste	11	111	10.09
Other construction materials	15	33	2.20
Other specified uses not listed	3	12	4.00
Unspecified: 4/			
Actual	2,590	20,800	8.02
Estimated	585	1,890	3.23
Total	3,340	23,500	7.06

1/ Data derived in part from the Alaska Division of Geological and Geophysical Surveys information.
2/ Includes traprock, and miscellaneous stone; excludes limestone-dolomite, sandstone, and slate from State total to avoid disclosing company proprietary data.
3/ Data are rounded to three significant digits, except unit value; may not add to totals shown.
4/ Reported and estimated production without a breakdown by end use.

TABLE 4
ALASKA: CONSTRUCTION SAND AND GRAVEL SOLD OR USED IN 1997,
BY MAJOR USE CATEGORY 1/ 2/

Use	Quantity (thousand metric tons)	Value (thousands)	Value per ton
Concrete aggregate (including concrete sand) 3/	1,340	$4,570	$3.42
Asphaltic concrete aggregates and other bituminous mixtures	266	2,360	8.86
Road base and coverings	344	3,000	8.73
Fill	777	3,890	5.01
Snow and ice control	44	425	9.66
Railroad ballast	41	315	7.68
Unspecified: Actual 4/	9,670	42,800	4.43
Total or average	12,500	57,400	4.60

1/ To avoid disclosing company proprietary data, no region tables were produced for 1997.
2/ Data are rounded to three significant digits; may not add to totals shown.
3/ Includes plaster and gunite sands and concrete products.
4/ Reported and estimated production without a breakdown by end use.

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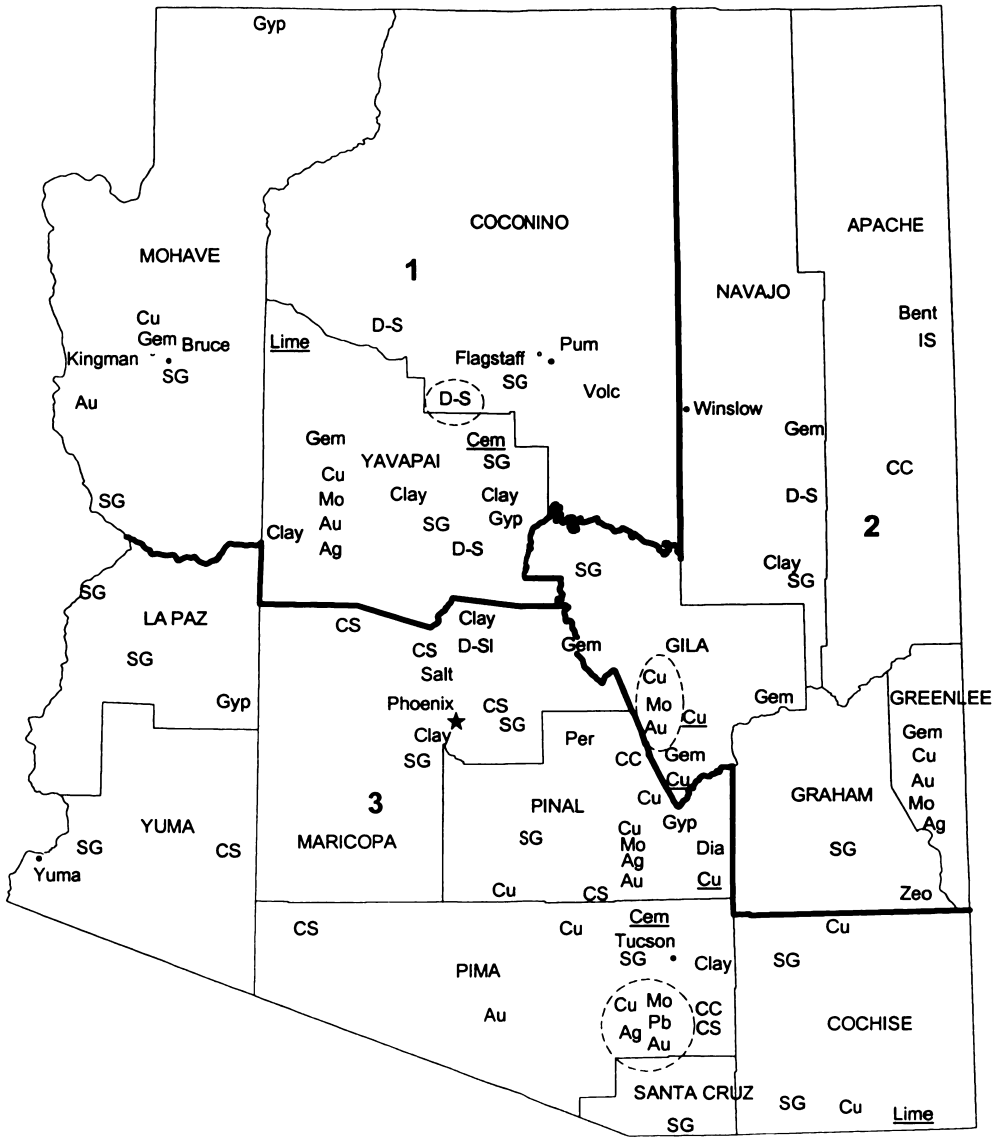
ARIZONA



LEGEND

- County boundary
- Capital
- City
- 1 — Crushed stone/sand and gravel districts

MINERAL SYMBOLS
(Major producing areas)

Ag	Silver
Au	Gold
Bent	Bentonite
Bruce	Brucite
Cem	Cement plant
Clay	Clay
CaC	Calcium carbonate
CS	Crushed stone
Cu	Copper
Cu	Copper plant
D-S	Dimension sandstone
D-Sl	Dimension slate
Dia	Diatomite
Gem	Gemstones
Gyp	Gypsum
IS	Industriral sand
Lime	Lime plant
Mo	Molybdenum
Pb	Lead
Per	Perlite
Pum	Pumice
Salt	Salt
SG	Sand and gravel
Volc	Volcanic cinders
Zeo	Zeolites
	Concentration of mineral operations

0 100 Kilometers

Source: Arizona Department of Mines and Minerals Resources/U.S. Geological Survey (1998)

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THE MINERAL INDUSTRY OF ARIZONA

This chapter has been prepared under a Memorandum of Understanding between the U.S. Geological Survey and the Arizona Department of Mines and Mineral Resources for collecting information on all nonfuel minerals.

In 1998, the preliminary estimated value[1] of nonfuel mineral production for Arizona was $2.82 billion, according to the U.S. Geological Survey (USGS). This was about a 20% decrease from the $3.54 billion of 1997,[2] and followed a 1.7% decrease from 1996 to 1997. The State ranked third in the Nation (first in 1997), in total nonfuel mineral production value, of which Arizona accounted for about 7% of the U.S. total.

Arizona continued in 1998 as the top copper-producing State, accounting for about 65% of total U.S. copper mine production and value. Copper was the State's leading nonfuel mineral, representing 75% of Arizona's 1998 total nonfuel mineral production value.

In 1998, although copper mine production was down only about 4%, most of the State's decrease in nonfuel mineral value resulted from a 26% drop in the metal's unit value. Other mineral commodity values that decreased included those of lime, gold, crude gypsum, crushed stone, and salt, in descending order of change. Increases in all other commodities, especially those of molybdenum, construction sand and gravel, and portland cement, bolstered the State's overall total value. In 1997, drops in the values of copper, gold, construction sand and gravel, and molybdenum accounted for most of the State's decrease in value (table 1).

Based on USGS estimates of the quantities produced in the United States during 1998, Arizona rose to first[2] from second in the production of molybdenum, to second from third in gemstones, to fifth from sixth in construction sand and gravel, and to seventh from ninth in dimension stone. Brucite production commenced in the State in 1998, and Arizona was first of two producing States. Otherwise, the State remained 4th in silver and zeolites, 5th in pumice and pumicite, and 11th of the 12 U.S. gold-producing States. Additionally, Arizona was a significant producer of portland and masonry cements, lime, and gypsum.

[1]The terms "nonfuel mineral production" and related "values" encompass variations in meaning, depending on the minerals or mineral products. Production may be measured by mine shipments, mineral commodity sales, or marketable production (including consumption by producers) as is applicable to the individual mineral commodity.

All 1998 USGS mineral production data published in this chapter are preliminary estimates as of February 1999 and are expected to change. For some commodities (for example, construction sand and gravel, crushed stone, and portland cement), estimates are updated periodically. To obtain the most current information, please contact the appropriate USGS mineral commodity specialist. A telephone listing for the specialists may be retrieved over the Internet at http://minerals.usgs.gov/minerals/contacts/comdir.html; by using MINES FaxBack at (703) 648-4999 from a fax machine with a touch-tone handset (request Document #1000 for a telephone listing of all mineral commodity specialists); or by calling USGS information at (703) 648-4000 for the specialist's name and number. All Mineral Industry Surveys–mineral commodity, State, and country–also may be retrieved over the Internet at http://minerals.usgs.gov/minerals or by way of MINES FaxBack.

[2]Values, percentage calculations, and rankings for 1997 may vary from the *Minerals Yearbook, Area Reports: Domestic 1997, Volume II*, owing to the revision of preliminary 1997 to final 1997 data. Data for 1998 are preliminary and expected to change, while related rankings may also be subject to change.

The Arizona Department of Mines and Mineral Resources[3] (ADMMR) provided the following narrative information. ASARCO Incorporated's Arizona operations consist of the open pit mines at Ray and Silver Bell, an open pit and underground operation at Mission, the Hayden copper smelter, and the Santa Cruz experimental copper mine. Copper output at the Ray Mine rose to 152,000 metric tons, up from 138,000 tons in 1997. The Ray Mine replaced its remaining 11 150-metric-ton-capacity haul trucks with 5, 220-metric-ton-capacity trucks in late 1997. The leaching process at Ray was changed to use higher acid concentrations to increase recovery rates. A $10 million electrowinning tankhouse expansion is underway that will add an additional 5,400 metric tons of capacity. When completed in mid-1999, total solvent extraction electrowinning capacity (SX-EW) will be 46,300 metric tons per year with a projected cash production cost of less than $0.50 per pound. As part of a negotiated settlement with the U.S. Environmental Protection Agency and State agencies to resolve environmental issues, Asarco will extend the Mineral Creek diversion tunnel around the Ray Mine workings at a cost of $55 million.

Mission copper production declined slightly in 1997 as harder ore was milled. Offsetting this, however, average ore grade increased as the underground mine contributed higher grade material for all of 1997. Production totaled 114,000 metric tons of copper. Mission was Arizona's largest silver producer with 67,500 kilograms recovered as a byproduct.

The Hayden smelter, an Inco Ltd.'s flash furnace rated at 653,000 metric tons of charge per year, processed a record amount of concentrates during 1997 producing 192,000 metric tons of copper. Improvements to the smelter's gas handling and process controls began during 1997. They are expected to lower operating costs and increase throughput upon completion in 1998.

Silver Bell's $70 million SX-EW plant was developed as a joint venture with Mitsui & Co. U.S.A. (25% share) and began production in July 1997. In 1998, the plant produced more than 18,000 tons of copper. Asarco reports cash costs to be $0.50 per pound.

At Santa Cruz, an experimental insitu leach research project, injection of leach solutions ceased after 22 months with many of the technical and environmental goals achieved along with the recovery of 16 metric tons of copper. Asarco and joint venture partner Freeport McMoran Copper & Gold Inc. have applied for permits for additional testing (without federal funds) at another site about 1.6 kilometers south of the initial test site. Information gathered there will provide data on the economics of insitu leaching the deposit.

Broken Hill Proprietary (BHP) Copper Co. reacted strongly to the lower copper prices early in 1998 by closing the sulfide portion of Pinto Valley's operations and delaying startup of the

[3]Nyal J. Niemuth, Mining Engineer, authored the text of State minerals information provided by the Arizona Department of Mines and Mineral Resources.

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Florence insitu leach. During the year, BHP also wrote down $388 million against the smelter and $543 million against its Arizona copper mines. The February 25 action at Pinto Valley resulted in the laying off of 447 workers, 75% of the workforce. Sulfide production was not scheduled to resume until solid and sustained improvements in price occur. In 1997, Pinto Valley produced 61,700 metric tons of copper in concentrate. In November, BHP reported that the San Manuel smelter would be operating at reduced capacity due to a shortfall in concentrate from the Pinto Valley closing. On October 22, 1997, a portion of the tailings dam failed at Pinto Valley, spilling tailings into Pinto Creek. By September 1998, a majority of the cleanup and restoration work was completed at a projected cost of over $30 million. BHP's San Manuel Mine is the largest underground operation in the United States and during its life has hoisted over 540 million metric tons of ore. It is the fourth largest copper mine in Arizona and produced 114,000 metric tons of copper in the fiscal year that ended May 31, 1998. The company is considering the resumption of mining oxide ore from the open pit developed in the subsidence area. Approximately 180 million metric tons would be heap leached, and the pregnant solutions fed to the existing solvent extraction electrowinning (SX-EW) plant. That plant continues to operate, but at reduced capacity, on solutions derived from insitu leaching.

In mid-1998, BHP reported discovery of the Magma Porphyry east of Superior. It is the first major copper discovery announced in Arizona in many years. The deposit, buried nearly 1.6 kilometers beneath the surface, was first intersected by drilling from the underground workings of the Magma Mine in 1995. Five holes drilled to date all showed significant mineralization and terminated in mineralized rock. Though its dimensions are incompletely defined, it is at least 460 meters high, 640 meters long, and 180 meters wide. Assays from the bottom 306 meters of the longest intercept yielded arithmetic mean grades of 1.75% copper and 0.029% molybdenum. The last 189 meters assayed 2.18% copper and 0.028% molybdenum. BHP is evaluating options for future exploration.

The Cyprus Climax Metals division of Cyprus Amax Minerals Co. is Arizona's second largest producer of copper and the world's largest producer of molybdenum. In response to low copper prices during 1998, Cyprus planned to reduce copper production by 27,000 metric tons from Bagdad and Sierrita. These cutbacks were made by reducing the use of their highest cost equipment. Additionally, expenditures were to be reduced by $10 million by deferring equipment purchases and holding other expenses to sustaining levels.

Cyprus Sierrita Corp. reported that 19 quarterly production and cost records were achieved by yearend 1998 (Cyprus Sierrita Corp., 1999). Cyprus Sierrita completed construction of two new in-pit crushers and a conveyor system to reduce haulage costs. Sierrita, recognized as one of the most efficient mines in the world, operates with the lowest average copper grade, 0.28%, of any milling operation. A contributing factor to this success is the mine's byproduct molybdenum credit of 9,000 metric tons, the largest in Arizona.

The Bagdad Mine in Yavapai County produced 112,000 metric tons of copper in 1997, a new production record. This resulted from mining higher grade sulfide ore, improved recovery, and increased equipment availability. Cyprus reports that Bagdad has nearly a 900-million-metric-ton proven and probable ore reserve of 0.38% copper and 0.021% molybdenum.

The Miami Mine consists of an openpit copper mine, a SX-EW, a 590,000-metric-ton-per-year capacity smelter with acid plant, an 172,000-metric-ton-annual-capacity electrolytic refinery, and an 122,000-metric-ton-per-year rod plant. The mine and SX-EW plant produced a record 71,000 metric tons of copper in 1997. The final Environmental Impact Statement and Record of Decision was issued by the U.S. Bureau of Land Management (BLM) and the Tonto National Forest for the Cyprus Miami Leach Expansion project. The project covers three new leach facilities and one waste rock dump. Total copper production through the life of the proposed expansion facilities is 1.3 million metric tons.

Phelps Dodge Corp. completed an $81 million expansion of the Morenci Mine adding 1,900 metric tons to monthly production beginning July 1998. The Southwest expansion project replaced an antiquated solvent extraction plant with a new one, constructed a new leach field in Stargo Canyon, and modernized the central electrowinning tankhouse to use stainless steel starter sheets. Use of these sheets saves making and shipping 35,000 copper starter sheets per week from the company's El Paso, TX, refinery as well as improving cathode quality.

Silver production in Arizona totaled 185 metric tons (table 1) recovered as a byproduct of copper mining. Arizona's only operating primary gold mine, Gold Road, produced 1,092 kilograms in 1997. Lower gold prices combined with other operating conditions caused Addwest Minerals Inc. to cease mining and milling in June 1998. Despite the closure, Addwest continued to add to its holdings in the Oatman district, acquiring rights to the United Western and United Eastern Mines adjacent to the Gold Road. Ore from these mines could be treated by the company's 450-metric-ton-per-day mill.

The BLM released the Yarnell gold mine's draft Environmental Impact Statement in June 1998. Bema Gold Corp., doing business in Arizona as Yarnell Mining Co., anticipates that construction could begin by mid-1999 if the record of decision and other permits are received. The mine will be operated as an open pit, heap-leach system producing 1,000 kilograms of gold per year over a 6-year mine life.

Unlike the metals segment, construction materials were in high demand as Arizona continued to enjoy robust population growth and a strong economy. The Arizona Department of Transportation's construction budget jumped 26% in 1998 and is expected to increase 13% in 1999 (Rock Products, 1998). Both cement producers in Arizona are considering expansion. During the next 5 years, Arizona portland cement's plant capacity will probably increase to 2.1 million metric tons per year. In the initial phase, capacity will increase to 1.42 million metric tons per year and involves installing a new raw feed roller mill and converting the existing raw feed mill into a finish mill. The second phase, planned for completion in 2003, requires installing a second pre-calcining tower. Phoenix Cement Co. has announced they have entered the planning stage for modernization of their Clarkdale operation. Plans include an increase in plant capacity from the current 570,000 metric tons of cement per year to 1 million metric tons per year.

After several years of development work, RMc Industries Inc. of Fort Collins, CO, will bring a brucite (natural magnesium hydroxide) deposit in Arizona into production in early 1998.

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The underground mine, near Kingman, will have a capacity of about 23,000 metric tons per year (Industrial Minerals, 1997).

In 1998, Salt River Sand & Rock Co., in Maricopa County, again operated one of the largest sand and gravel plants in the United States. Vulcan Materials Co. acquired Calmat Co. in November 1998 for $760 million and the assumption of Calmat's debt of $130 million. Calmat of Arizona has 479 employees at its seven Phoenix area plants. The merger further solidifies Vulcan's position as the nation's largest producer of construction aggregates (Vulcan Materials Co., November 16, 1998, press release, accessed April 20, 1999, at URL http://www.vulcanmaterials.com/press/calmat.htm). Omya Arizona Inc. continued work on plans and permits for a new calcium carbonate processing plant at Superior in Pinal County. The Drake and Ashfork sandstone quarries and processing plant of Western States Stone were acquired by American Sandstone. Western States' schist quarries in the Mayer area were acquired by Apache Stone and their marketing and stone yards were combined into Garden State Stone.

Arizona is the leading State in the value of mined gemstones in the United States. Although best known for turquoise and petrified wood, amethyst from the Four Peaks Mine in Maricopa County has been coveted by faceters and collectors since the turn of the century. The mine, inactive for over 10 years, was purchased in late 1997 and reactivated. The amethyst is mined by hand, flown by helicopter to Phoenix (the property is surrounded by the U.S. Forest Services' Four Peaks Wilderness Area), and shipped to Bangkok for faceting.

Mine fraud is of increasing concern to stock exchanges and government security regulators. Some scandals with connections to Arizona were reported by the Toronto Stock Exchange and the Ontario Securities Commission, and included International Platinum (IP) and Delgratia and Naxos (Toronto Stock Exchange and the Ontario Securities Commission, 1998). In early 1998, International Precious Metals (successor to IP who was delisted by the Toronto Stock Exchange), was delisted by the NASDAQ stock exchange. Other examples reported during 1998 include the Arizona Corp. Commission issuing a cease and desist order to Black Diamond Mining and Federal grand jury indictments of four Phoenix area individuals on 30 charges involving activities at the Henrietta Mine.

These types of activities were the impetus for the Ontario Securities Commission and the TSE to form the mining standards task force to review standards governing the conduct of mineral exploration programs and reporting of results. The task force's interim report, made four key recommendations: 1) designate a qualified person to sign off on exploration disclosures, 2) establish best exploration and field practices to ensure integrity of results, 3) raise disclosure standards, and 4) improve regulatory oversight.

According to the ADMMR, a common occurrence is the reporting of gold or other precious metals where none exists. Investors seem vulnerable to promotions that claim to be able to detect or recover gold that reputable laboratories cannot detect. Despite regulatory agencies investigations and shutdowns, investors should remain wary as the proposed improvements are expected to discourage, but not stop, mine fraud.

In August 1998, the U.S. District Court in Phoenix approved a $100 million settlement to clean up damage to Pinal Creek, Gila County, caused by acid mine drainage. The settlement, the largest environmental agreement in Arizona's history, involves Cyprus Miami Mining Corp., BHP Copper Inc., and Inspiration Consolidated Copper Co. (Mining Week, 1998).

The Arizona legislature established the abandoned mines safety fund. Administered by the Arizona Mine Inspector, the only use of such funds is for actual abatement costs to close or fence shafts and adits on State trust lands. Donations to the fund may be matched by appropriations from the legislature.

For a more complete discussion of Arizona's Mineral Industry along with a detailed listing of the mines and operators see Directory 47, *Active Mines in Arizona 1999* available from the Arizona Department of Mines and Mineral Resources.

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TABLE 1
NONFUEL RAW MINERAL PRODUCTION IN ARIZONA 1/ 2/

(Thousand metric tons and thousand dollars unless otherwise specified)

Mineral		1996 Quantity	1996 Value	1997 Quantity	1997 Value	1998 p/ Quantity	1998 p/ Value
Clays: Common		104	W	W	W	W	W
Copper 3/		1,240	2,980,000 r/	1,250	2,940,000	1,200	2,120,000
Gemstones		NA	2,360	NA	2,360	NA	2,780
Gold 3/	kilograms	2,990 r/	37,500 r/	2,140	22,800	2,100	20,000
Molybdenum	do.	W	W	14,400	W	16,700	W
Sand and gravel:							
Construction		41,900	199,000	39,500	187,000	46,900	229,000
Industrial		323	2,890	330	3,160	337	3,940
Silver 3/	metric tons	189 r/	31,500 r/	190	29,900	185	30,300
Stone: Crushed		6,800	40,600	7,490	44,000	7,400	43,300
Zeolites	metric tons	(4/)	NA	(4/)	NA	NA	NA
Combined values of brucite (1998), cement, clays (bentonite), gypsum, (crude), iron oxide pigments (crude), lime, perlite (crude), pumice and pumicite, salt, stone (dimension sandstone), and values indicated by symbol W		XX	308,000	XX	312,000	XX	374,000
Total		XX	3,600,000 r/	XX	3,540,000	XX	2,820,000

p/ Preliminary. r/ Revised. NA Not available. W Withheld to avoid disclosing company proprietary data; value included with "Combined values" data. XX Not applicable.

1/ Production as measured by mine shipments, sales, or marketable production (including consumption by producers).

2/ Data are rounded to three significant digits; may not add to totals shown.

3/ Recoverable content of ores, etc.

4/ Withheld to avoid disclosing company proprietary data.

TABLE 2
ARIZONA: CRUSHED STONE SOLD OR USED, BY KIND 1/

Kind	1996 Number of quarries	1996 Quantity (thousand metric tons)	1996 Value (thousands)	1996 Unit value	1997 Number of quarries	1997 Quantity (thousand metric tons)	1997 Value (thousands)	1997 Unit Value
Limestone	6	4,110	$23,000	$5.60	6	4,590	$23,300	$5.07
Granite	12	1,540	8,580	5.57	12	1,580	10,700	6.74
Marble	3	W	W	8.24	3	W	W	11.69
Sandstone and quartzite	2	W	W	12.58	2	W	W	16.10
Volcanic cinder and scoria	5	238	542	2.28	4	115	135	1.17
Miscellaneous stone	2	W	W	9.04	4	948	6,010	6.34
Total	XX	6,800	40,600	5.97	XX	7,490	44,000	5.86

W Withheld to avoid disclosing company proprietary data; included in "Total." XX Not applicable.

1/ Data are rounded to three significant digits, except unit value; may not add to totals

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TABLE 3
ARIZONA: CRUSHED STONE SOLD OR USED BY PRODUCERS
IN 1997, BY USE 1/ 2/

Use	Quantity (thousand metric tons)	Value (thousands)	Unit value
Coarse aggregate (+1 1/2 inch), riprap and jetty stone	W	W	$3.18
Fine aggregate (-3/8): Stone sand, concrete	W	W	11.10
Coarse and fine aggregates:			
Graded road base or subbase	63	$72	1.14
Unpaved road surfacing	35	43	1.23
Terrazzo and exposed aggregate	109	2,010	18.47
Crusher run or fill or waste	1	11	11.00
Other coarse and fine aggregates	4	59	14.75
Other agricultural uses 3/	10	152	15.20
Chemical and metallurgical:			
Cement manufacture	W	W	5.62
Lime manufacture	W	W	4.04
Flux stone	W	W	13.19
Sulfur oxide removal	W	W	11.42
Special:			
Whiting or whiting substitute	W	W	11.44
Roofing granules	3	63	21.00
Other miscellaneous uses not listed: Unspecified: 4/	3	27	9.00
Actual	1,310	10,300	7.87
Estimated	996	6,020	6.05
Total	7,490	44,000	5.86

W Withheld to avoid disclosing company proprietary data; included in "Total."
1/ Includes granite, limestone, marble, miscellaneous stone, sandstone and quartzite, and volcanic cinder and scoria.
2/ Data are rounded to three significant digits, except unit value; may not add to totals shown.
3/ Includes poultry grit and mineral food.
4/ Includes reported and estimated production without a breakdown by end use.

TABLE 4
ARIZONA: CRUSHED STONE SOLD OR USED BY PRODUCERS IN 1997,
BY USE AND DISTRICT 1/ 2/

(Thousand metric tons and thousand dollars)

Use	District 1		District 2		District 3		Unspecified districts	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
Construction aggregates:								
Coarse aggregate (+1 1/2 inch) 3/	--	--	W	W	W	W	--	--
Fine aggregate (-3/8 inch) 4/	--	--	W	W	W	W	--	--
Coarse and fine aggregate 5/	W	W	W	W	W	W	--	--
Agricultural 6/	--	--	--	--	W	W	--	--
Chemical and metallurgical 7/	W	W	--	--	W	W	--	--
Special 8/	--	--	--	--	W	W	--	--
Unspecified: 9/								
Actual	W	W	--	--	W	W	879	5,380
Estimated	W	W	--	--	W	W	--	--
Total	2,350	11,600	3	9	4,260	27,000	879	5,380

W Withheld to avoid disclosing company proprietary data; included in "Total."
1/ Data are rounded to three significant digits; may not add to totals shown.
2/ Includes granite, limestone, marble, miscellaneous stone, quartzite, sandstone, and volcanic cinder and scoria.
3/ Includes filter stone.
4/ Includes stone sand (concrete).
5/ Includes terrazzo and exposed aggregates, crusher run (select material of fill), and other coarse and fine aggregates.
6/ Includes poultry grit and mineral food and other agricultural uses.
7/ Includes cement manufacture, lime manufacture, flux stone, and sulfur oxide removal.
8/ Includes whiting or whiting substitute and other uses.
9/ Includes reported and estimated production without a breakdown by end use.

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TABLE 5
ARIZONA: CONSTRUCTION SAND AND GRAVEL SOLD OR USED IN 1997,
BY MAJOR USE CATEGORY 1/

Use	Quantity (thousand metric tons)	Value (thousands)	Value per ton
Concrete aggregate (including concrete sand)	12,700	$66,200	$5.20
Plaster and gunite sands	1,270	4,740	3.73
Concrete products (blocks, bricks, pipe, decorative, etc.)	24	195	8.13
Asphaltic concrete aggregates and other bituminous mixtures	4,130	23,200	5.63
Road base and coverings 2/	10,500	39,700	3.78
Fill	731	1,940	2.65
Snow and ice control	13	138	10.62
Other miscellaneous uses 3/	249	1,040	4.16
Unspecified: 4/			
Actual	5,110	26,600	5.21
Estimated	4,750	23,600	4.96
Total or average	39,500	187,000	4.74

1/ Data are rounded to three significant digits, except value per ton; may not add to totals shown.
2/ Includes road and other stabilization (cement and lime).
3/ Includes filtration and railroad ballast.
4/ Includes reported and estimated production without a breakdown by end use.

TABLE 6
ARIZONA: CONSTRUCTION SAND AND GRAVEL SOLD OR USED IN 1997,
BY USE AND DISTRICT 1/

(Thousand metric tons and thousand dollars)

Use	District 1		District 2		District 3		Unspecified districts	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
Concrete aggregate and concrete products	846	5,340	288	1,820	11,600	59,300	--	--
Plaster and gunite sands	72	788	20	155	1,180	3,800	--	--
Asphaltic concrete aggregates and other bituminous mixtures	654	4,980	128	631	2,930	16,700	419	924
Road base materials 2/	752	3,650	168	1,080	8,800	33,700	799	1,320
Fill	22	63	197	678	513	1,200	--	--
Other miscellaneous uses 3/	2	13	15	158	5,090	27,200	--	--
Unspecified: 4/								
Actual	--	--	W	W	W	W	265	438
Estimated	1,210	5,720	607	2,260	2,940	15,600	--	--
Total	3,560	20,500	1,420	6,780	33,100	157,000	1,480	2,680

W Withheld to avoid disclosing company proprietary data; included with "Other miscellaneous uses."
1/ Data are rounded to three significant digits; may not add to totals shown.
2/ Includes road and other stabilization (cement and lime).
3/ Includes filtration, railroad ballast, and snow and ice control.
4/ Includes reported and estimated production without a breakdown by end use.

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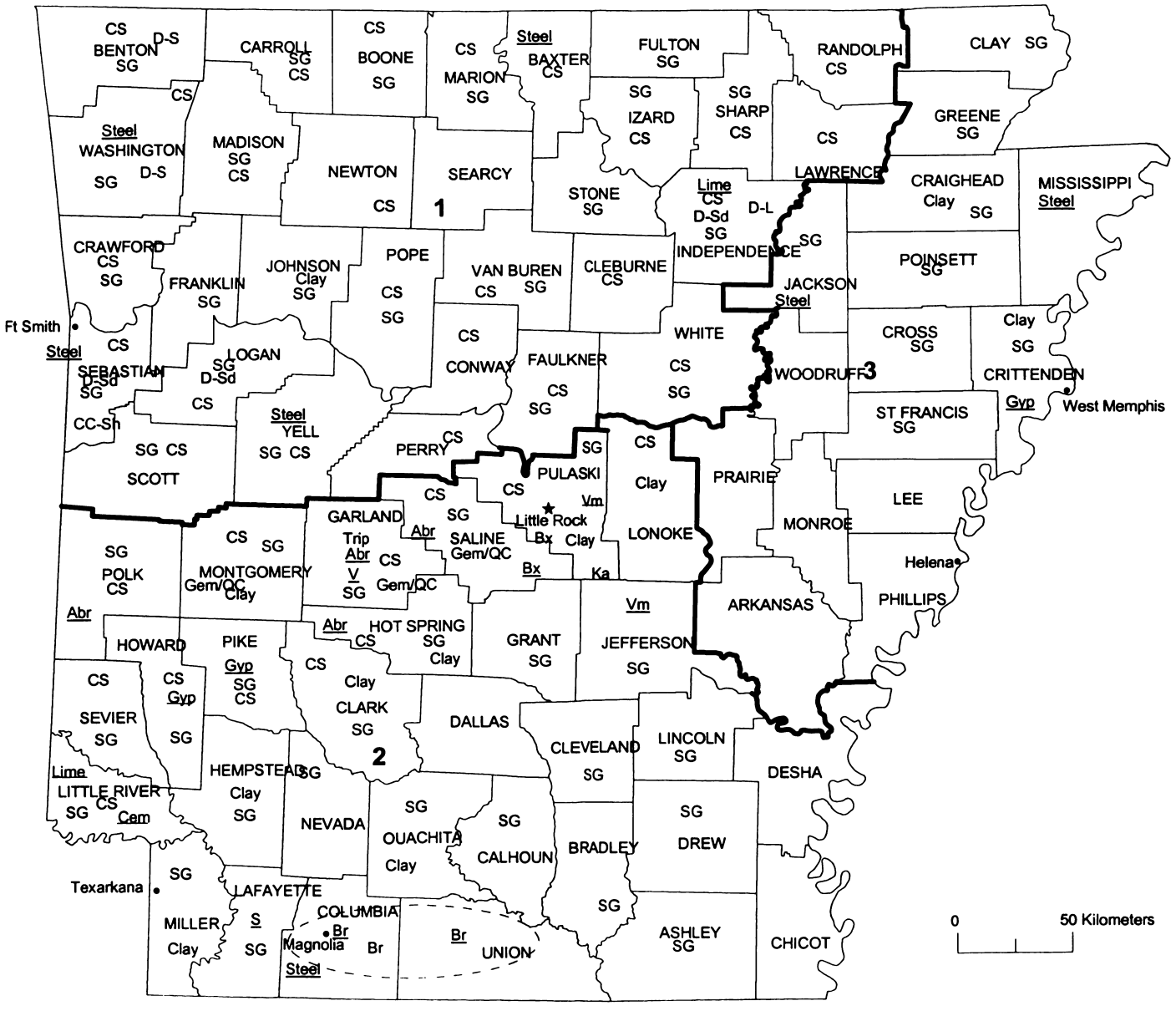
ARKANSAS



LEGEND

- County boundary
- ★ Capital
- • City
- 1 Crushed stone/sand and gravel districts

MINERAL SYMBOLS
(Major producing areas)

Abr	Abrasives plant
Br	Bromine
Br	Bromine plant
Bx	Bauxite
Bx	Bauxite plant
CC-Sh	Common clay and shale
Cem	Cement plant
Clay	Clay
CS	Crushed stone
D-S	Dimension stone
D-Sd	Dimension sandstone
D-L	Dimension limestone
Gem/QC	Quartz crystal
Gyp	Gypsum plant
Ka	Kaolin
Lime	Lime plant
S	Sulfur plant
SG	Sand and gravel
Steel	Steel plant
Trip	Tripoli
V	Vanadium plant
Vm	Vermiculite plant
	Concentration of mineral operations

Source: Arkansas Geological Commission/U.S. Geological Survey (1998)

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THE MINERAL INDUSTRY OF ARKANSAS

This chapter has been prepared under a Memorandum of Understanding between the U.S. Geological Survey and the Arkansas Geological Commission for collecting information on all nonfuel minerals.

In 1998, the preliminary estimated value[1] of nonfuel mineral production for Arkansas was $598 million, according to the U.S. Geological Survey (USGS). This was a 23% increase from that of 1997,[2] following a 12% increase from 1996 to 1997. The State climbed in rank in 1998 to 24th from 29th among the 50 States in total nonfuel mineral production value, of which Arkansas accounted for more than 1% of the U.S. total.

In 1998, the rise in Arkansas' nonfuel mineral value was mainly attributable to substantial increases in the production and value of crushed stone (table 1) and the value of bromine, although there was a small drop in bromine production. Increases in construction sand and gravel and portland cement also contributed to the State's increase in value. Only kaolin with a $3 million decrease and gypsum with a much smaller drop had reduced values, while industrial sand and gravel remained the same. In 1997, the largest portion of Arkansas' value increase occurred as a result of rising values for bromine and crushed stone. Construction sand and gravel and kaolin also moderately contributed to the State's increase for the year.

Based on USGS estimates of quantities produced in the 50 States during 1998, Arkansas continued to be the leading[2] bromine-producing State, accounting for most U.S. production. Michigan was the only other State that produced bromine. Mining operations in both States extracted subsurface bromine-rich natural brines by submersible pump for subsequent processing. Arkansas also remained first of three States that produce silica stone; third of four tripoli-producing States; fourth in kaolin; eighth in common clay; and ninth in crude gypsum. By value, Arkansas rose from seventh to sixth in the Nation in the production of gemstones. Gemstone production must be measured in dollars because of the lack of a physical unit common to all gemstones produced. Additionally, significant quantities of crushed stone and construction and industrial sand and gravel were produced in the State. The State's metal production, mostly that of raw steel, resulted from materials received from other domestic and foreign sources.

The Arkansas Geological Commission[3] (AGC) provided the following narrative information. Custom mining of bauxite continued on a sporadic basis by McGeorge Construction Co. on Alcoa property in Saline County. Alcoa continued mining of bauxite in Saline County for the production of propants used by the oil industry in formation fracturing procedures.

Brominated flame retardants are used in epoxies, phenolics, acrylonitrile-butadiene-styrene, polystyrene, polycarbonates, and unsaturated polyesters. Albemarle finalized plans to build a 50,000-metric-ton-per-year production facility for tetrabromobisphenol-A (TBBPA), a flame retardant. The plant project is to be located near Magnolia, AR. Construction began in August 1998, and the plant is scheduled to begin commercial production in the third quarter of 1999. The plant will use new, continuous process technology to produce TBBPA. On April 1, 1998, Albemarle completed a major expansion of its SAYTEX 8010 Flame Retardant production capacity at its Magnolia, AR, facility in early 1998. According to company sources, the expansion adds more than 3,000 metric tons to capacity, enabling continuing supply for global needs.

Ash Grove Cement Co.operates the Rocky Point plant in Little River County. Source materials include chalk from the Annona Chalk and silica from the Marlbrook Marl, both formations are Late Cretaceous in age.

On June 9, 1998, the new Federal Transportation Equity Act for the 21st Century (TEA-21) was signed into law. TEA-21 authorizes $217.3 billion for federal highway and transit programs ($175 billion for the highway program, with at least $165 billion guaranteed spending nationwide). This has dramatically increased exploration and acquisitions activity in Arkansas' aggregate industry.

Arkhola Sand and Gravel Co. continued exploration for additional quarry sites in several formations in the western portion of the Arkansas River Valley. Bennett Brothers Stone Co., Inc. obtains rough fieldstone, dimension stone, and other building stone materials from deposits in Garland County and nearby counties. Bobby Plant Asphalt Company, based in Murfreesboro, Pike County, continues the development and production phase efforts of a major quarry in the Jackfork Sandstone (Pennsylvanian) south of Kirby in central Pike County. Duffield Stone and Gravel Co. opened their new Gumlog quarry in upper Atoka sandstone (Pennsylvanian) in Pope County and also are proceeding with further exploration in the region. McClinton-Anchor, Inc. proceeded with exploration for new aggregate quarry sites, mostly examining limestones (Mississippian) in the Ozarks Plateau region of northwest Arkansas. McGeorge Construction Co.'s Granite Mountain quarries operations recovered fully from the effects of major damage from a tornado on March 1, 1997. Granite Mountain

[1]The terms "nonfuel mineral production" and related "values" encompass variations in meaning, depending on the minerals or mineral products. Production may be measured by mine shipments, mineral commodity sales, or marketable production (including consumption by producers) as is applicable to the individual mineral commodity.

All 1998 USGS mineral production data published in this chapter are preliminary estimates as of February 1999 and are expected to change. For some mineral commodities (for example, construction sand and gravel, crushed stone, and portland cement), estimates are updated periodically. To obtain the most current information, please contact the appropriate USGS mineral commodity specialist. A telephone listing for the specialists may be retrieved over the Internet at http://minerals.usgs.gov/minerals/contacts/comdir.html; by using MINES FaxBack at (703) 648-4999 from a fax machine with a touch-tone handset (request Document #1000 for a telephone listing of all mineral commodity specialists); or by calling USGS information at (703) 648-4000 for the specialist's name and number. All Mineral Industry Surveys—mineral commodity, State, and country—also may be retrieved over the Internet at http://minerals.usgs.gov/minerals; facsimile copies may be obtained from MINES FaxBack.

[2]Values, percentage calculations, and rankings for 1997 may vary from the *Minerals Yearbook, Area Reports: Domestic 1997, Volume II*, owing to the revision of preliminary 1997 to final 1997 data. Data for 1998 are preliminary and expected to change, while related rankings may also be subject to change.

[3]J. Michael Howard, Geology Supervisor, authored the text of State minerals information provided by the Arkansas Geological Commission.

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quarries also acquired some potential aggregate-producing property in the western portion of the Arkansas Valley. Martin-Marietta Co. acquired Meredian Co.'s quarry and operations at the Hatton quarry in southern Polk County. Mid-State Materials, Inc. also was acquired by Martin Marietta Aggregates and continues the crushed stone operation at the 51 Quarry site near Magnet Cove in Hot Spring County. Martin Marietta Aggregates acquired interest in Meridian Aggregates Co. with an option to purchase the balance of Meridian's holdings in Arkansas in the future. Minnesota Mining and Manufacturing Company continue production of rock from its Big Rock Arch Street Pike quarry to supply its roofing granule plant in Sweet Home, Pulaski County. Provo Co., based in east Texas, began sporadic processing of dump material from the HMB quarry in the Jackfork Sandstone in Sevier County. Pyramid Stone Company began quarrying and crushing stone from sandstone quarries near Greenbriar, Faulkner County, and near Centerville, Yell County. Rock Products, Inc. continues to explore the potential of rock aggregate resources in Morrowan- and Atokan-age (Pennsylvanian) sandstones in Cleburne and White Counties.

Rogers Group, Inc. proceeded with exploration quarries of sandstones of the upper and middle Atoka at Toad Suck in eastern Perry County, north of Greenbriar, and at Beryl in Faulkner County. Rogers Group is currently producing crushed stone for aggregates and fill material from the Tidwell quarry in the Arkansas Novaculite formation (Mississippian-Devonian) in Hot Spring County, and is also investigating its potential as a high-silica resource for ferrosilicon use. Rogers Group also acquired the DeRoche quarry and is producing aggregates from the Jackfork Sandstone.

Schwartz Stone Co. quarries sandstone from the Hartshorne Sandstone (Pennsylvanian) both as crushed aggregate and dimension stone north of Midway in Logan County. Texas Industries Group continues the evaluation of tuff from leased property in southern Polk County.

Vulcan Materials Co. of Birmingham, AL, acquired Searcy Asphalt and Material, Inc. and is continuing to test the upper Morrowan sandstone (Pennsylvanian) for crushed stone at a quarry operation at Judsonia in White County. Vulcan is continuing dolomitic limestone production from lower Ordovician age rocks near Black Rock in Lawrence County. They also are actively processing rock from the L & R quarry in middle Atoka Sandstone near Floyd in White County. Charles Weaver Co. began development of a quarry and crushing facility in the middle Atoka Formation near El Paso in White County.

There continues to be a major use of rock from about 30 privately operated quarries on paper company lands (Weyerhauser and International Paper). The crushed rock is used in the numerous company-constructed timber access roads on their lands. Most counties in the Paleozoic region (northwestern half of the State) have their own county quarries. The materials from these quarry operations are used by the counties as aggregates and road fill. Several major communities also have large quarry operations that supply crushed stone and fill material.

James Hardie Gypsum Co. began construction of a $60 million expansion of its Nashville plant (formerly known as Briar plant). The expansion will double the facility's wall board production capacity to 130 million square meters per year and will result in an additional 75 to 80 jobs at the plant, which presently employs about 370 people. The company has seen its U.S. gypsum business nearly quadruple in the past year. Production for 1998 was about 590,000 metric tons of raw gypsum ore from which 65 million square meters of wallboard was produced. The plant has proven 30-year reserves on-site through exploration and land acquisitions. Principal markets for the company's wallboard products are Alabama, Kentucky, Mississippi, and Indiana. James Hardie has announced plans to move their corporate offices to San Diego, CA, and base operations out of the United States by midyear 1999.

C.W. (Bill) Harrison Gypsum Co. of Oklahoma continued gypsum-mining operations north of Highland, Pike County. Gypsum from this operation is consumed as a cement additive by Ashgrove Cement Co. in Little River County.

The Butterfield quarry in Hot Spring County, recently operated by Harbison-Walker Refractories Co., is now managed and operated by the Clovis Wallis Whetstones, Inc. for high-purity silica applications. Clovis Wallis Whetstones, Inc., also continues to crush novaculite for high-silica demands at a site south of Lonsdale near the Saline-Hot Spring County line. Lascas Products, Inc., ceased operations at its facility near Jessieville, Garland County, and have the plant for sale. The company trucked its plant feedstock from mines northeast of the plant site in northern Saline County in 1997. A private citizen of Jessieville, Garland County, continues to produce an undisclosed amount of lascas. The Rogers Group continues to evaluate high-silica novaculite in the Ouachita Mountains for potential use in the ferrosilicon and silicon markets.

Arkansas' only lime production facility, near Batesville, is owned by Arkansas Lime Co. The company continue production of calcined product from the Boone Formation (Lower Mississippian). The quarry is about 3 kilometers east of its secondary crusher and kiln operation. The ore is hand sorted after primary crushing and transported to the calcining plant by narrow-gauge rail.

The four largest whetstone operators in the State continue active manufacturing with Norton Abrasive Co. and Smith's Abrasives, Inc., leading the way. The relatively new Norton plant in southern Garland County affords them better continuity of operations than the previous procedure of shipping the raw rock out-of-State. Hall's Whetstones Inc. is also expanding activities and markets, principally for novaculite products.

Peyton Creek Minerals, based in Dallas, TX, was permitted for phosphate operations and conducted investigations in northern Van Buren County.

There were approximately 100 active sand and gravel operations in Arkansas in 1998, the greatest number of these being in the southeastern one-half of the State (the Gulf Coastal Plain). For 1998, three new sand and gravel permits were issued by the Arkansas Department of Pollution Control and Ecology. The companies are Whitehall Gravel Co., Poinsett County; North Little Rock Materials, Inc. in Pulaski County; and Martin Sand and Gravel, Newton County.

Malvern Minerals Co. continues actively mining tripoli from a deposit in the upper Arkansas Novaculite (Mississippian) in eastern Garland County. Some tripoli is obtained from the Big Fork Chert (Ordovician) in a county-operated quarry in western Saline County.

Umetco, Inc. initiated reclamation of the Wilson Springs mines area in Garland County in late 1997 and has continued

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this effort through 1998. The last production of vanadium ore from Arkansas was in 1990.

Very limited exploration was conducted in Arkansas in 1998 for metals. Midwest Mining Supplies, Inc., Nashville, AR, continues limited prospecting for base-metals in Polk and Montgomery Counties.

A new publication by the AGC was completed and published in 1998 entitled Information Circular 36, *Stratigraphic Summary of Arkansas.* The publication is intended to be a companion document to the *Geologic Map of Arkansas* (1976, 1993).

In 1998, six geologic maps on 7.5-minute topographic base of southwest Arkansas were digitized: Murfreesboro, Locksburg, Geneva, Silver Ridge, Ben Lomond, and Falls Chapel. The AGC accomplished this work as a cooperative effort with the USGS. The USGS STATEMAP program partially funds the project.

A paper and two poster sessions relating to testing at the Crater of Diamonds State Park near Murfreesboro in Pike County, celestine deposits in southwest Arkansas, and rock aggregate resources, were presented at the Industrial Minerals Forum at Norman, OK. Two of these presentations are scheduled to be published in the annual Industrial Minerals Forum papers compendium by the Oklahoma Geological Survey in 1999. A poster session, which presented information about the STATEMAP cooperative project, was presented at the South-Central GSA Meeting in Norman, OK.

The AGC web site (www.state.ar.us/agc/agc.htm) hosted over 2,000 visitors during its first year on-line. Information posted on the web pages includes resource data, maps, and publications available along with ordering information, stratigraphic data, agency service information, and other items concerning the geology of the Arkansas.

A researcher at The Center for Energy, Natural Resources, & Environmental Studies (CENRES) at Arkansas Tech University, Russellville, completed a study of the relation between the various geologic units being quarried in the Paleozoic region of Arkansas and certain engineering properties of rock (principally the Los Angeles abrasion and sodium sulfate soundness tests). The Arkansas Geological Commission, the Arkansas Highway and Transportation Department, and the U.S. Corps of Engineers are cooperating in this study by supplying base maps and engineering test data to CENRES. A report is scheduled for publication in 1999.

The U.S. Forest Service had 136 contracts from which operators produced about 899,000 metric tons of building stone, rip-rap, and aggregate related materials (shale and chert), generating about $40,000 in revenue for the Federal Government from the three National Forests in Arkansas--the Ouachita, the Ozark, and the St. Francis.

Operators of 40 quartz contracts with the U.S. Forest Service on the Ouachita National Forest in Arkansas generated around $22,400 in revenue. About 150 metric tons of quartz were removed from quartz mines on the National Forest. Annual hard-rock lease payments on the Ouachita National Forest is estimated at $10,000.

In cooperation with the U.S. Forest Service and the State Geological Surveys of Oklahoma and Missouri, the Arkansas Geological Commission continued to participate in a fact-finding effort for the U.S. Forest Service's Ouachita-Ozark Highlands Assessment study. Every 10 to 15 years, the U.S. Forest Service is required to establish planning guidelines for forest and land use for the next decade. The major product will be a report on various aspects of the National Forests in this region (the Ozark National Forest, the Ouachita Forest, and the Mark Twain National Forest). The three National Forests coordinated efforts to study the regional assessment area. Present in this report is a summary of the mineral data for the assessment region. The individual State-based data reports will be on an accompanying CD-ROM. This is the fact-finding report on which policy decisions will be made for the next 10 to 15 years. The actual policy report for the three National Forests must be completed by year 2001.

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TABLE 1
NONFUEL RAW MINERAL PRODUCTION IN ARKANSAS 1/ 2/

(Thousand metric tons and thousand dollars unless otherwise specified)

Mineral	1996 Quantity	1996 Value	1997 Quantit	1997 Value	1998 p/ Quantity	1998 p/ Value
Clays:						
Common	939	2,390	979	1,400	999	1,430
Kaolin	161	W	W	W	W	W
Gemstones	NA	3,050	NA	980	NA	1,090
Sand and gravel: Construction	11,000	43,500	10,600	48,100	11,300	52,800
Silica stone 3/ metric tons	398	4,040 r/	424	2,540	NA	NA
Stone: Crushed	26,400	158,000	28,100	167,000	38,600	241,000
Combined values of bromine, cement, clays (fire, 1996), gypsum (crude), lime, sand and gravel (industrial), stone (dimension limestone, marble, and sandstone), tripoli, and values indicated by symbol W	XX	225,000	XX	267,000	XX	301,000
Total	XX	435,000 r/	XX	487,000	XX	598,000

p/ Preliminary. r/ Revised. NA Not available. W Withheld to avoid disclosing company proprietary data; value included with "Combined values" data. XX Not applicable.
1/ Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
2/ Data are rounded to three significant digits; may not add to totals shown.
3/ Grindstones, pulpstones, and sharpening stones; excludes mill liners and grinding pebbles.

TABLE 2
ARKANSAS: CRUSHED STONE SOLD OR USED, BY KIND 1/

Kind	1996 Number of quarries	1996 Quantity (thousand metric tons)	1996 Value (thousands)	1996 Unit value	1997 Number of quarries	1997 Quantity (thousand metric tons)	1997 Value (thousands)	1997 Unit value
Limestone	22 r/	6,990 r/	$34,900 r/	$4.99 r/	24	8,370	$41,900	$5.00
Dolomite	2 r/	W	W	4.66 r/	2	W	W	4.02
Granite	6	9,720	75,100	7.72	6	10,000	77,200	7.69
Sandstone	20 r/	6,920 r/	34,300 r/	4.95 r/	17	6,710	34,500	5.15
Quartzite	2	W	W	5.01 r/	1	W	W	5.25
Sandstone-quartzite	1	(2/)	(2/)	(2/)	--	--	--	--
Miscellaneous stone	1	(2/)	(2/)	(2/)	1	W	W	4.71
Total	XX	26,400	158,000	5.96	XX	28,100	167,000	5.94

r/ Revised. W Withheld to avoid disclosing company proprietary data; included in "Total." XX Not applicable.
1/ Data are rounded to three significant digits; may not add to totals shown.
2/ Revised to zero.

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TABLE 3
ARKANSAS: CRUSHED STONE SOLD OR USED
BY PRODUCERS IN 1997, BY USE 1/ 2/

Use	Quantity (thousand metric tons)	Value (thousands)	Unit value
Coarse aggregate (+1 1/2 inch):			
Riprap and jetty stone	214	$896	$4.19
Filter stone	24	147	6.13
Other coarse aggregate	(3/)	(3/)	4.79
Coarse aggregate, graded:			
Concrete aggregate, coarse	1,000	4,930	4.92
Bituminous aggregate, coarse	223	1,480	6.62
Bituminous surface-treatment aggregate	94	594	6.32
Railroad ballast	54	278	5.15
Other graded coarse aggregate	(3/)	(3/)	4.89
Fine aggregate (-3/8 inch):			
Stone sand, concrete	(3/)	(3/)	5.56
Screening, undesignated	202	1,050	5.19
Other fine aggregate	(3/)	(3/)	4.40
Coarse and fine aggregates:			
Graded road base or subbase	3,330	15,300	4.61
Unpaved road surfacing	W	W	2.87
Crusher run or fill or waste	130	719	5.53
Other coarse and fine aggregates	W	W	4.55
Other construction materials	773	3,340	4.32
Agricultural:			
Agricultural limestone	181	1,120	6.20
Poultry grit and mineral food	50	680	13.60
Other agricultural uses	25	243	9.72
Chemical and metallurgical:			
Cement manufacture	(3/)	(3/)	2.92
Lime manufacture	(3/)	(3/)	4.73
Special:			
Mine dusting or acid water treatment	15	80	5.33
Asphalt fillers or extenders	1	18	18.00
Other fillers or extenders	(3/)	(3/)	12.58
Roofing granules	(3/)	(3/)	5.00
Unspecified: 4/			
Actual	13,500	88,000	6.51
Estimated	5,880	38,000	6.47
Total	28,100	167,000	5.94

W Withheld to avoid disclosing company proprietary data; included with "Other construction materials."
1/ Data are rounded to three significant digits, except unit value; may not add to totals shown.
2/ Includes dolomite, granite, limestone, miscellaneous stone, quartzite, and sandstone.
3/ Withheld to avoid disclosing company proprietary data; included in "Total."
4/ Includes reported and estimated production without a breakdown by end use.

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TABLE 4
ARKANSAS: CRUSHED STONE SOLD OR USED BY PRODUCERS IN 1997,
BY USE AND DISTRICT 1/

(Thousand metric tons and thousand dollars)

Use	District 1		District 2		District 3		Unspecified districts	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
Construction aggregates:								
Coarse aggregate (+1 1/2 inch) 2/	205	1,010	W	W	W	W	136	571
Coarse aggregate, graded 3/	W	W	W	W	W	W	197	824
Fine aggregate (-3/8 inch) 4/	W	W	--	--	--	--	91	380
Coarse and fine aggregate 5/	3,640	16,100	W	W	W	W	80	337
Other construction materials	1,900 6/	10,000 6/	514	2,750	55	499	--	--
Agricultural 7/	256	2,050	--	--	--	--	--	--
Chemical and metallurgical 8/	(9/)	(9/)	(9/)	(9/)	--	--	--	--
Special 10/	(9/)	(9/)	(9/)	(9/)	--	--	--	--
Unspecified: 11/								
Actual	6,360	30,500	7,150	57,500	--	--	--	--
Estimated	1,340	9,020	(9/)	(9/)	--	--	--	--
Total	14,000	71,200	13,600	93,100	55	499	504	2,110

W Withheld to avoid disclosing company proprietary data; included with "Other construction materials."
1/ Data are rounded to three significant digits; may not add to totals shown.
2/ Includes filter stone and riprap and jetty stone.
3/ Includes concrete aggregate (coarse), bituminous aggregate (coarse), bituminous surface treatment aggregate, railroad ballast, and other graded coarse aggregates.
4/ Includes stone sand (concrete), stone sand (bituminous mix or seal), and screening (undesignated).
5/ Includes graded road base or subbase, unpaved road surfacing, and crusher run (select material or fill).
6/ Includes other coarse aggregate.
7/ Includes agricultural limestone, and other agricultural uses.
8/ Includes cement and lime manufacture, flux stone, and chemical stone for alkali works.
9/ Withheld to avoid disclosing company proprietary data; included in "Total."
10/ Includes mine dusting or acid water treatment, asphalt fillers or extenders, whiting or whiting substitute, and other fillers or extenders.
11/ Includes reported and estimated production without a breakdown by end use.

TABLE 5
ARKANSAS: CONSTRUCTION SAND AND GRAVEL SOLD OR USED IN 1997,
BY MAJOR USE CATEGORY 1/

Use	Quantity (thousand metric tons)	Value (thousands)	Value per ton
Concrete aggregate (including concrete sand) 2/	2,740	$13,400	$4.87
Asphaltic concrete aggregates and other bituminous mixtures	962	6,200	6.44
Road base and coverings	460	1,480	3.21
Fill	121	417	3.45
Other miscellaneous uses 3/	50	244	4.88
Unspecified: 4/			
Actual	5,060	22,100	4.36
Estimated	1,190	4,290	3.61
Total or average	10,600	48,100	4.54

1/ Data are rounded to three significant digits; may not add to totals shown.
2/ Includes concrete products.
3/ Includes filtration, and snow and ice control.
4/ Includes reported and estimated production without a breakdown by end use.

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TABLE 6

ARKANSAS: CONSTRUCTION SAND AND GRAVEL SOLD OR USED IN 1997, BY USE AND DISTRICT 1/

(Thousand metric tons and thousand dollars)

Use	District 1		District 2		District 3	
	Quantity	Value	Quantity	Value	Quantity	Value
Concrete aggregates and concrete products	408	2,160	W	W	W	W
Asphaltic concrete aggregates and road base	200	682	816	3,870	465	3,310
Other miscellaneous uses 2/	2,270	7,030	4,290	21,400	1,350	6,520
Unspecified: 3/						
Actual	W	W	W	W	--	--
Estimated	W	W	793	3,070	W	W
Total	2,880	9,870	5,900	28,400	1,810	9,830

W Withheld to avoid disclosing company proprietary data; included with "Other miscellaneous uses."
1/ Data are rounded to three significant digits; may not add to totals shown.
2/ Includes fill, filtration, and snow and ice control.
3/ Includes reported and estimated production without a breakdown by end use.

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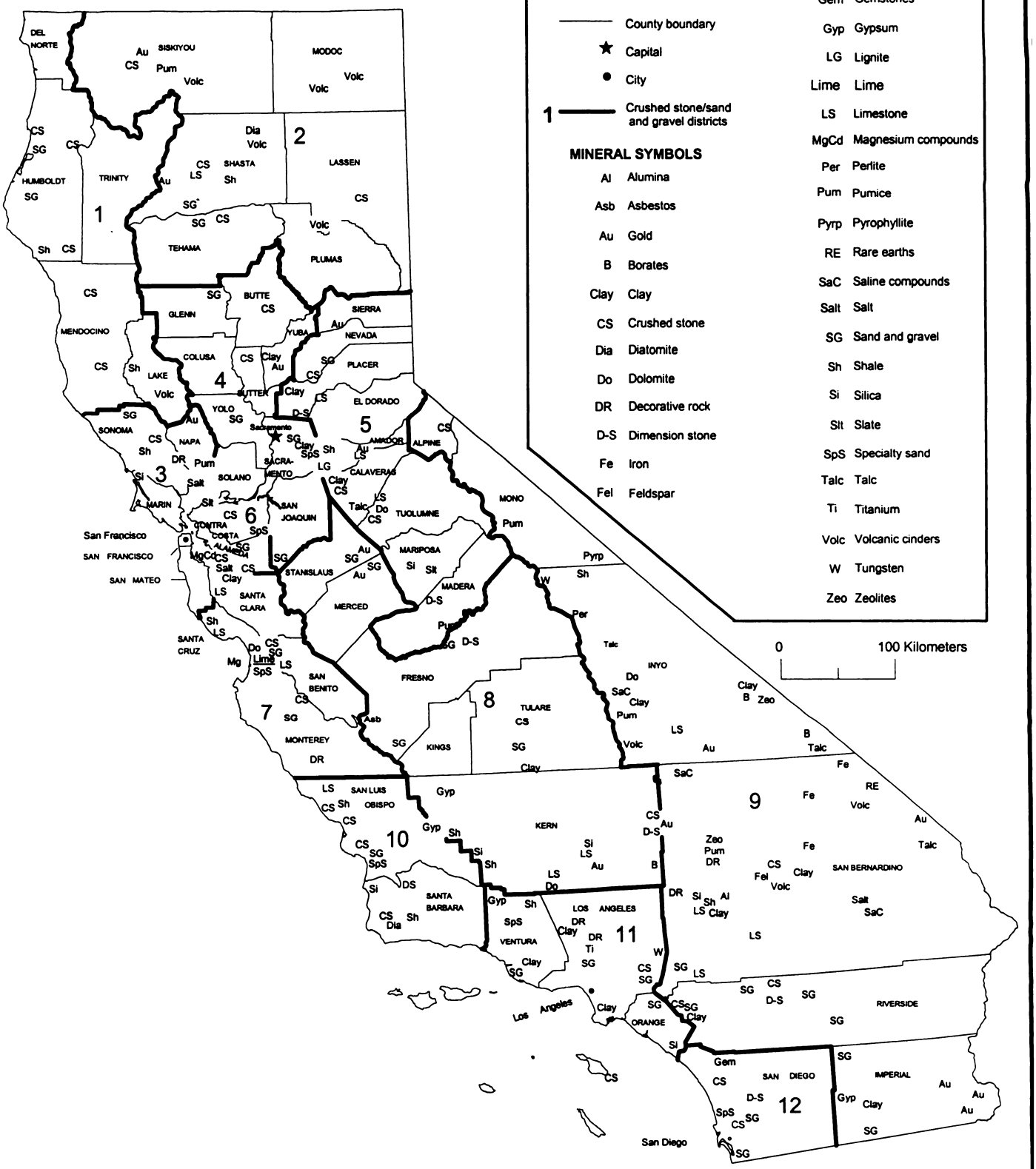
CALIFORNIA



Source: California Department of Conservation, Division of Mines and Geology/U.S. Geological Survey (1998)

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THE MINERAL INDUSTRY OF CALIFORNIA

This chapter has been prepared under a Memorandum of Understanding between the U.S. Geological Survey and the California Department of Conservation, Division of Mines and Geology, for collecting information on all nonfuel minerals.

In 1998, the preliminary estimated value[1] of nonfuel mineral production for California was $2.97 billion, according to the U.S. Geological Survey (USGS). This was about a 2% decrease from that of 1997,[2] and followed a 7% increase in 1997 from 1996. The State rose in rank to second from third in the Nation in total nonfuel mineral production value, of which California accounted for more than 7% of the U.S. total.

Industrial minerals accounted for more than 93% of California's nonfuel mineral value; the remaining value mostly resulted from the mining of gold and silver. Construction sand and gravel, portland cement, boron minerals, and crushed stone, in descending order of value, were the leading industrial minerals in 1998, accounting for nearly 79% of the State's total industrial nonfuel mineral value. Whereas the majority of the State's nonfuel mineral commodities increased in value, only the values of construction sand and gravel, crushed stone, and portland cement (mineral listings in descending magnitude of change) significantly increased. These increases moderated significant decreases in boron, gold, rare-earth metal concentrates, salt, and soda ash (table 1). Smaller increases took place in magnesium compounds, natural sodium sulfate, industrial sand and gravel, crude gypsum, and fuller's earth, while potash and pumice showed similar-size decreases. All other changes in value were incremental. Bentonite, feldspar, fire clays, iron ore, kaolin, perlite, and talc (alphabetical order) decreased while all others showed small increases. In 1997, increases in the values of portland cement, construction sand and gravel, boron, and crushed stone accounted for most of the year's increase, which was somewhat mitigated by decreases in gold, bentonite, soda ash, and potash (table 1).

Based on USGS estimates of the quantities produced in the United States during 1998, California continued as the Nation's only[2] State to produce boron, rare-earth metal concentrates, and asbestos (this and the following listing groups are in descending order of value). The State remained first in the production of construction sand and gravel, portland cement, diatomite, and first of two States that produced natural sodium sulfate. California continued second in gold, second of two States that produced soda ash, second in magnesium compounds and feldspar, and second of three States that produce titanium (ilmenite). The State remained third in industrial sand and gravel and perlite, fourth in gemstones, fifth in crude gypsum and kaolin, sixth in fuller's earth and talc, eighth in silver, and ninth in masonry cement. California dropped to fourth from third in pumice and pumicite and fire clays and to ninth from seventh in salt. Additionally, significant quantities of crushed stone, common clays, and dimension stone were produced in the State.

The following narrative information was provided by the California Department of Conservation, Division of Mines and Geology.[3]

Industrial Minerals

Permits for new and expanded sand and gravel operations were granted by several city, county, and Federal agencies. Coast Rock Co. and Kaiser Sand and Gravel Co. were granted a use permit in December 1997 to mine sand and gravel along 27 kilometers of the Santa Maria and Sisquock rivers in Santa Barbara and San Luis Obispo Counties. West Coast Aggregates Inc.'s permit to mine rock in southern Santa Clara County was approved in September 1998 by the County Board of Supervisors. Mining operations are expected to begin in early summer 1999. Other permits were granted for aggregate mining in Trinity, Fresno, Mendocino, and Yolo Counties.

Several acquisition and mergers took place during the year. Vulcan Materials Co., the largest producer of aggregate in the United States, announced their acquisition of CalMat Co. in November. The deal was worth about $890 million. The acquisition gives Vulcan control of 2 billion metric tons of aggregate resources in Arizona, California, and New Mexico. Prior to the takeover, Vulcan did not operate in the western United States. Nelson and Sloan, the third largest aggregate producer in San Diego County, was purchased by Cornerstone Construction and Materials for $37.3 million. Nelson and Sloan produces 2 million metric tons per year from three operations in the San Diego area. The acquisition will add about 142 million metric tons to Cornerstone's reserves. Pioneer Southwestern acquired Asphalt Inc. (San Diego County) in November 1998. The deal included approximately 36 million metric tons of reserves. Chemical Lime Co., based in Fort Worth, TX, acquired National Refractories Inc.'s Natividad dolomite quarry and processing plant (Monterey County) in late December 1997.

[1]The terms "nonfuel mineral production" and related "values" encompass variations in meaning, depending on the minerals or mineral products. Production may be measured by mine shipments, mineral commodity sales, or marketable production (including consumption by producers) as is applicable to the individual mineral commodity.

All 1998 USGS mineral production data published in this chapter are preliminary estimates as of February 1999 and are expected to change. For some commodities (for example, construction sand and gravel, crushed stone, and portland cement), estimates are updated periodically. To obtain the most current information, please contact the appropriate USGS mineral commodity specialist. A telephone listing for the specialists may be retrieved over the Internet at http://minerals.usgs.gov/minerals/contacts/comdir.html; by using MINES FaxBack at (703) 648-4999 from a fax machine with a touch-tone handset (request Document #1000 for a telephone listing of all mineral commodity specialists); or by calling USGS information at (703) 648-4000 for the specialist's name and number. All Mineral Industry Surveys–mineral commodity, State, and country–also may be retrieved over the Internet at http://minerals.usgs.gov/minerals or by way of MINES FaxBack.

[2]Values, percentage calculations, and rankings for 1997 may vary from the *Minerals Yearbook, Area Reports: Domestic 1997, Volume II*, owing to the revision of preliminary 1997 to final 1997 data. Data for 1998 are preliminary and expected to change, while related rankings may also be subject to change.

[3]Susan Kohler-Antablin, Associate Geologist, authored the text of information submitted by the Division of Mines and Geology.

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Chemical Lime Co. will continue to produce dolomite for industrial and chemical applications.

Two of California's largest aggregate associations, the Central Valley Rock, Sand and Gravel Association and the Aggregate Producers Association of Northern California merged to form the Construction Materials Association of California. The new organization should provide a stronger voice for the California aggregate industry.

Grefco Minerals, Inc. closed its diatomite mine and plant near Lompoc (Santa Barbara County) in August. The company had been processing diatomaceous earth at the Lompoc site since the 1950's. Increasing regulatory pressures and environmental scrutiny were cited as the reason for closing. The Celite Corp. has acquired Grefco Minerals' reserves.

Molycorp Inc.'s world class Mountain Pass rare-earths mine (San Bernardino County) ceased refinery operations in March 1998 after operating continuously since 1951. Molycorp continued to produce bastnasite concentrates. The Mountain Pass Mine was the only producer of rare earths in the United States. Molycorp Inc., a subsidiary of Unocal Corp., agreed to pay a $410,000 fine for spilling low-level radioactive waste into the high desert from a broken pipeline. Molycorp is currently developing safer methods to dispose of the waste in hopes of reopening and expanding its mine in the near future.

Metals

Despite continued low gold prices in 1998, gold mining continued to dominate the State's metallic mineral production. Newmont Gold Co.'s Mesquite Mine (Imperial County) continued to lead the State in production for the year. Homestake's McLaughlin Mine (Napa, Lake, and Yolo Counties) was the second largest gold producer in the State followed closely by Viceroy Gold Corp.'s Castle Mountain Mine (San Bernardino County). The McLaughlin Mine ceased mining in 1996 but will continue to produce gold from stockpiled ores until about 2005.

The Sutter Gold Mining Co. was granted a use permit in September to mine underground at the Lincoln Mine project (Amador County). The mine is expected to open in 2000.

Viceroy Gold Corp.'s Castle Mountain Mine expansion project (San Bernardino County) got its final approval from the U.S. Bureau of Land Management in July 1998. The expansion will extend the mine life to 2001.

Golden Queen Mining Co.'s Soledad Mountain Mine and heap leaching project (Kern County) received a final permit from the Regional Water Quality Control Board in March. Reserves are estimated at 44 million metric tons, averaging 1.1 grams of gold per metric ton. The company is waiting to initiate construction upon stabilization of gold prices at $350 per troy ounce.

Glamis Imperial Corp.'s Imperial Gold Mining Project (Imperial County) continued its permitting process throughout the year. The project has identified approximately 86 million metric tons of ore with an average grade of 0.55 grams of gold per metric ton.

Newmont Gold Co. has identified a northern extension of their ore body after conducting an extensive exploration program during the year. The exploration took place in two one-half sections north of the Mesquite Mine's Big Chief Pit (Imperial County). Newmont is currently in the process of obtaining a permit to mine these additional resources.

Royal Gold Inc. continues exploration at its Inyo Gold Project (Mono County). Probable reserves are estimated at about 22,000 kilograms of gold.

Chemgold Inc. finished mining its ore body at the Picacho Mine (Imperial County) in January. The mine has been in operation for the last 18 years. Heap leaching will continue for the next 2 to 3 years.

CalEnergy Minerals LLC awarded a contract to Kvaerner (an international engineering and construction group) in September 1998 for a $148 million zinc recovery plant located at the Salton Sea (Imperial County). Scheduled for completion in mid-2000, the plant is expected to produce 27,000 metric tons per year of zinc from brine generated at CalEnergy Minerals' geothermal power plants.

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TABLE 1
NONFUEL RAW MINERAL PRODUCTION IN CALIFORNIA 1/ 2/

(Thousand metric tons and thousand dollars unless otherwise specified)

Mineral		1996 Quantity	1996 Value	1997 Quantity	1997 Value	1998 p/ Quantity	1998 p/ Value
Asbestos	metric tons	9,550	W	6,890	W	W	W
Boron minerals		1,150	519,000	604 3/	580,000	619 3/	440,000
Cement:							
Masonry		198	14,500 e/	169	13,500 e/	172	14,200
Portland		9,910	616,000 e/	10,300	705,000 e/	10,600	747,000
Clays:							
Bentonite		148	13,900	29	3,420	W	W
Common		1,340	12,600	937	10,300	956	10,500
Fire		60	W	W	W	W	W
Fuller's earth		224	W	W	W	W	W
Kaolin		W	W	75	W	W	W
Gemstones		NA	507	NA	1,330	NA	1,470
Gold 4/	kilograms	24,200 r/	304,000 r/	24,200 r/	258,000 r/	18,700	178,000
Lime		208	19,200 r/	200	20,300	208	20,400
Rare-earth metal	metric tons	20,400	W	20,000 e/	W	10,000	W
Sand and gravel:							
Construction		103,000	583,000	115,000	668,000	125,000	752,000
Industrial		1,760	40,500	1,920	44,900	1,930	46,200
Silver 4/	metric tons	22	3,610	23	3,550	22	3,610
Stone:							
Crushed		46,700	295,000	49,600	325,000	57,200	395,000
Dimension	metric tons	28,600	7,020	26,200	4,300	28,300	4,600
Combined values of diatomite, feldspar, gypsum (crude), iron ore (usable), magnesium compounds, mercury, perlite (crude), potash (1996-97), pumice and pumicite, salt, soda ash, sodium sulfate (natural), talc and pyrophyllite, titanium concentrates (ilmenite), and values indicated by symbol W		XX	409,000 r/	XX	401,000	XX	358,000
Total		XX	2,840,000 r/	XX	3,040,000 r/	XX	2,970,000

e/ Estimated. p/ Preliminary. r/ Revised. NA Not available. W Withheld to avoid disclosing company proprietary data; value included with "Combined values" data. XX Not applicable.

1/ Production as measured by mine shipments, sales, or marketable production (including consumption by producers).

2/ Data are rounded to three significant digits; may not add to totals shown.

3/ Weight reported as B_2O_3 and is not comparable to prior years.

4/ Recoverable content of ores, etc.

TABLE 2
CALIFORNIA: CRUSHED STONE SOLD OR USED, BY KIND 1/

Kind	1996 Number of quarries	1996 Quantity (thousand metric tons)	1996 Value (thousands)	1996 Unit value	1997 Number of quarries	1997 Quantity (thousand metric tons)	1997 Value (thousands)	1997 Unit value
Limestone	22 r/	22,100 r/	$123,000 r/	$5.56 r/	22	22,900	$131,000	$5.73
Dolomite	8	384	2,670	6.95	8	282	2,790	9.89
Marble	2	W	W	W	2	W	W	W
Shell	1	W	W	W	1	W	W	W
Granite	20 r/	8,350 r/	56,000 r/	6.71 r/	19	9,230	69,500	7.52
Traprock	23 r/	8,290 r/	60,500 r/	7.30 r/	24	11,200	82,300	7.35
Sandstone and quartzite	7 r/	854 r/	5,590 r/	6.55 r/	7	1,030	6,050	5.91
Slate	2	W	W	W	2	W	W	W
Volcanic cinder and scoria	4	420	3,450	8.21	3	484	3,450	7.13
Miscellaneous stone	19 r/	6,100 r/	41,200 r/	6.75 r/	12	4,120	26,700	6.49
Total	XX	46,700	295,000	6.31	XX	49,600	325,000	6.56

r/ Revised. W Withheld to avoid disclosing company proprietary data; included in "Total." XX Not applicable.

1/ Data are rounded to three significant digits; may not add to totals shown.

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TABLE 3
CALIFORNIA: CRUSHED STONE SOLD OR USED BY PRODUCERS IN 1997, BY USE 1/ 2/

Use	Quantity (thousand metric tons)	Value (thousands)	Unit value
Coarse aggregate (+1 1/2 inch):			
Riprap and jetty stone	1,760	$15,400	$8.73
Filter stone	140	925	6.61
Other coarse aggregate 3/	51	174	3.41
Coarse aggregate, graded:			
Concrete aggregate, coarse	1,410	12,900	9.16
Bituminous aggregate, coarse	1,140	9,100	7.99
Bituminous surface-treatment aggregate	608	9,860	16.22
Railroad ballast	1,310	9,440	7.20
Other graded coarse aggregate	97	784	8.08
Fine aggregate (-3/8 inch):			
Stone sand, bituminous mix or seal	873	7,930	9.08
Screening, undesignated	731	3,570	4.88
Other fine aggregate 4/	434	4,110	9.47
Coarse and fine aggregates:			
Graded road base or subbase	4,750	30,100	6.35
Unpaved road surfacing	91	631	6.93
Terrazzo and exposed aggregate	92	1,300	14.12
Crusher run or fill or waste	2,190	7,650	3.49
Other coarse and fine aggregates	3,520	13,800	3.94
Other construction materials	1,280	11,100	8.67
Agricultural:			
Agricultural limestone	57	769	13.49
Other agricultural uses 5/	116	1,580	13.62
Chemical and metallurgical:			
Cement manufacture	11,800	44,200	3.73
Lime manufacture	W	W	5.83
Sulfur oxide removal	W	W	16.15
Special:			
Asphalt fillers or extenders	(6/)	(6/)	16.67
Whiting or whiting substitute	(6/)	(6/)	33.07
Other fillers or extenders	(6/)	(6/)	19.65
Roofing granules	(6/)	(6/)	13.05
Other specified uses not listed 7/	998	28,500	28.59
Unspecified: 8/			
Actual	4,680	42,100	8.99
Estimated	11,400	69,000	6.05
Total	49,600	325,000	6.56

W Withheld to avoid disclosing company proprietary data; included in "Total."
1/ Includes dolomite, granite, limestone, marble, miscellaneous stone, sandstone and quartzite, shell, slate, traprock, and volcanic cinder and scoria.
2/ Data are rounded to three significant digits, except unit value; may not add to totals shown.
3/ Includes macadam.
4/ Includes stone sand, concrete.
5/ Includes poultry grit and mineral food.
6/ Withheld to avoid disclosing company proprietary data; included with "Other specified uses not listed."
7/ Includes flour (slate).
8/ Includes reported and estimated production without a breakdown by end use.

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TABLE 4
CALIFORNIA: CRUSHED STONE SOLD OR USED BY PRODUCERS IN 1997, BY USE AND DISTRICT 1/

(Thousand metric tons and thousand dollars)

Use	District 1		District 2		District 3		District 4		District 5	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
Construction aggregates:										
Coarse aggregate (+1 1/2 inch) 2/	W	W	W	W	166	1,370	568	5,240	W	W
Coarse aggregate, graded 3/	--	--	W	W	W	W	W	W	W	W
Fine aggregate (-3/8 inch) 4/	--	--	W	W	W	W	W	W	W	W
Coarse and fine aggregate 5/	W	W	W	W	1,410	8,470	W	W	442	2,300
Other construction materials 6/	193	1,230	535	3,440	356	4,410	2,280	16,600	522	3,600
Agricultural 7/	--	--	(8/)	(8/)	--	--	--	--	--	--
Chemical and metallurgical 9/	(8/)	(8/)	--	--	--	--	--	--	--	--
Special 10/	--	--	--	--	--	--	--	--	(8/)	(8/)
Other miscellaneous uses 11/	(8/)	(8/)	(8/)	(8/)	--	--	--	--	--	--
Unspecified: 12/										
Actual	5	64	--	--	(8/)	(8/)	--	--	--	--
Estimated	--	--	--	--	(8/)	(8/)	--	--	(8/)	(8/)
Total	250	1,520	551	3,660	3,540	30,000	2,850	21,900	2,710	17,800

	District 6		District 7		District 8		District 9		District 10	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
Construction aggregates:										
Coarse aggregate (+1 1/2 inch) 2/	W	W	156	2,180	W	W	W	W	W	W
Coarse aggregate, graded 3/	W	W	W	W	W	W	W	W	W	W
Fine aggregate (-3/8 inch) 4/	W	W	W	W	W	W	W	W	W	W
Coarse and fine aggregate 5/	2,350	12,200	3,490	15,900	W	W	14	245	W	W
Other construction materials 6/	1,270	12,600	3,420	30,400	574	3,580	518	4,030	473	3,540
Agricultural 7/	(8/)	(8/)	(8/)	(8/)	--	--	--	--	--	--
Chemical and metallurgical 9/	--	--	(8/)	(8/)	1,950	6,400	6,900	23,000	(8/)	(8/)
Special 10/	--	--	--	--	--	--	(8/)	(8/)	(8/)	(8/)
Other miscellaneous uses 11/	--	--	--	--	--	--	(8/)	(8/)	(8/)	(8/)
Unspecified: 12/										
Actual	(8/)	(8/)	--	--	(8/)	(8/)	W	W	--	--
Estimated	--	--	--	--	(8/)	(8/)	2,820	18,300	--	--
Total	3,650	24,900	10,100	63,400	6,590	34,100	12,200	84,000	627	5,920

	District 11		District 12		Unspecified districts	
	Quantity	Value	Quantity	Value	Quantity	Value
Construction aggregates:						
Coarse aggregate (+1 1/2 inch) 2/	W	W	--	--	--	--
Coarse aggregate, graded 3/	W	W	--	--	--	--
Fine aggregate (-3/8 inch) 4/	W	W	--	--	--	--
Coarse and fine aggregate 5/	W	W	(8/)	(8/)	--	--
Other construction materials 6/	1,250	4,790	--	--	--	--
Agricultural 7/	--	--	--	--	--	--
Chemical and metallurgical 9/	--	--	--	--	--	--
Special 10/	--	--	--	--	--	--
Other miscellaneous uses 11/	--	--	--	--	--	--
Unspecified: 12/						
Actual	(8/)	(8/)	--	--	54	(13/)
Estimated	(8/)	(8/)	(8/)	(8/)	--	--
Total	5,530	32,000	928	5,630	54	(13/)

W Withheld to avoid disclosing company proprietary data; included with "Other construction materials."
1/ Data are rounded to three significant digits; may not add to totals shown.
2/ Includes filter stone, macadam, riprap and jetty stone, and other coarse aggregate.
3/ Includes concrete aggregate (coarse), bituminous aggregate (coarse), bituminous surface-treatment aggregate, railroad ballast, and other graded coarse aggregate.
4/ Includes stone sand (bituminous mix or seal), screening (undesignated), and other fine aggregate.
5/ Includes graded road base or subbase, terrazzo and exposed aggregate, unpaved road surfacing, crusher run (select material or fill), and other coarse and fine aggregates.
6/ Includes drain fields and roofing granules.
7/ Includes agricultural limestone, poultry grit and mineral food, and other agricultural uses.
8/ Withheld to avoid disclosing company proprietary data; included in "Total."
9/ Includes cement manufacture, glass manufacture, and sulfur oxide removal.
10/ Includes other fillers or extenders and whiting or whiting substitute.
11/ Includes other specified uses not listed.
12/ Includes reported and estimated production without a breakdown by end use.
13/ Less than 1/2 unit.

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TABLE 5
CALIFORNIA: CONSTRUCTION SAND AND GRAVEL SOLD OR USED IN 1997,
BY MAJOR USE CATEGORY 1/

Use	Quantity (thousand metric tons)	Value (thousands)	Value per ton
Concrete aggregate (including concrete sand)	32,000	$194,000	$6.07
Plaster and gunite sands	2,510	16,200	6.47
Concrete products (blocks, bricks, pipe, decorative, etc.)	1,010	7,390	7.33
Asphaltic concrete aggregates and other bituminous mixtures	13,100	95,800	7.29
Road base and coverings 2/	13,800	75,100	5.45
Fill	5,010	16,900	3.37
Snow and ice control	69	650	9.42
Railroad ballast	76	352	4.63
Other miscellaneous uses 3/	1,480	7,480	5.07
Unspecified: 4/			
Actual	32,400	188,000	5.79
Estimated	13,000	65,800	5.05
Total or average	115,000	668,000	5.83

1/ Data are rounded to three significant digits, except value per ton; may not add to totals shown.
2/ Includes road and other stabilization (cement and lime).
3/ Includes filtration and railroad ballast.
4/ Includes reported and estimated production without a breakdown by end use.

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TABLE 6
CALIFORNIA: CONSTRUCTION SAND AND GRAVEL SOLD OR USED IN 1997,
BY USE AND DISTRICT 1/

(Thousand metric tons and thousand dollars)

Use	District 1		District 2		District 3	
	Quantity	Value	Quantity		Quantity	Value
Concrete aggregate and concrete products 2/	397	3,470	166	855	606	5,680
Asphaltic concrete aggregates and other bituminous mixtures	500	5,890	W	W	W	W
Road base materials 3/	458	2,980	638	2,530	W	W
Other miscellaneous uses 4/	W	W	W	W	W	W
Unspecified: 5/						
Actual	W	W	4	22	685	6,220
Estimated	129	730	730	3,930	318	2,130
Total	1,540	13,100	1,760	9,640	2,370	19,200

	District 4		District 5		District 6	
	Quantity	Value	Quantity		Quantity	Value
Concrete aggregate and concrete products 2/	6,400	42,400	997	7,050	2,300	16,200
Asphaltic concrete aggregates and other bituminous mixtures	3,930	34,000	529	3,560	W	W
Road base materials 3/	5,590	29,900	902	5,890	1,530	8,140
Other miscellaneous uses 4/	553	1,830	W	W	W	W
Unspecified: 5/						
Actual	19	185	--	--	3,120	23,400
Estimated	1,350	9,860	W	W	307	2,190
Total	17,800	118,000	3,410	22,500	8,670	61,300

	District 7		District 8		District 9	
	Quantity	Value	Quantity		Quantity	Value
Concrete aggregate and concrete products 2/	967	8,670	3,720	21,700	7,230	36,000
Asphaltic concrete aggregates and other bituminous mixtures	W	W	1,360	7,720	2,740	13,700
Road base materials 3/	452	2,860	1,930	9,170	2,660	11,300
Other miscellaneous uses 4/	--	--	W	W	181	1,230
Unspecified: 5/						
Actual	W	W	W	W	5,520	26,100
Estimated	--	--	1,510	6,310	2,880	8,480
Total	2,700	20,800	10,500	55,500	21,200	96,800

	District 10		District 11		District 12	
	Quantity	Value	Quantity		Quantity	Value
Concrete aggregate and concrete products 2/	603	6,780	9,840	56,700	2,210	16,000
Asphaltic concrete aggregates and other bituminous mixtures	W	W	2,060	13,000	W	W
Road base materials 3/	810	3,020	2,700	10,700	W	W
Other miscellaneous uses 4/	W	W	W	W	--	--
Unspecified: 5/						
Actual	122	603	W	W	7,530	41,100
Estimated	--	--	907	4,750	3,940	21,800
Total	1,900	11,600	28,100	157,000	14,300	81,000

	Unspecified districts	
	Quantity	Value
Concrete aggregate and concrete products 2/	--	--
Asphaltic concrete aggregates and other bituminous mixtures	64	369
Road base materials 3/	172	998
Other miscellaneous uses 4/	--	--
Unspecified: 5/		
Actual	83	136
Estimated	--	--
Total	318	1,500

W Withheld to avoid disclosing company proprietary data; included in "Total."
1/ Data are rounded to three significant digits; may not add to totals shown.
2/ Includes plaster and gunite sands.
3/ Includes fill, road and other stabilization (cement and lime), and snow and ice control.
4/ Includes railroad ballast.
5/ Includes reported and estimated production without a breakdown by end use.

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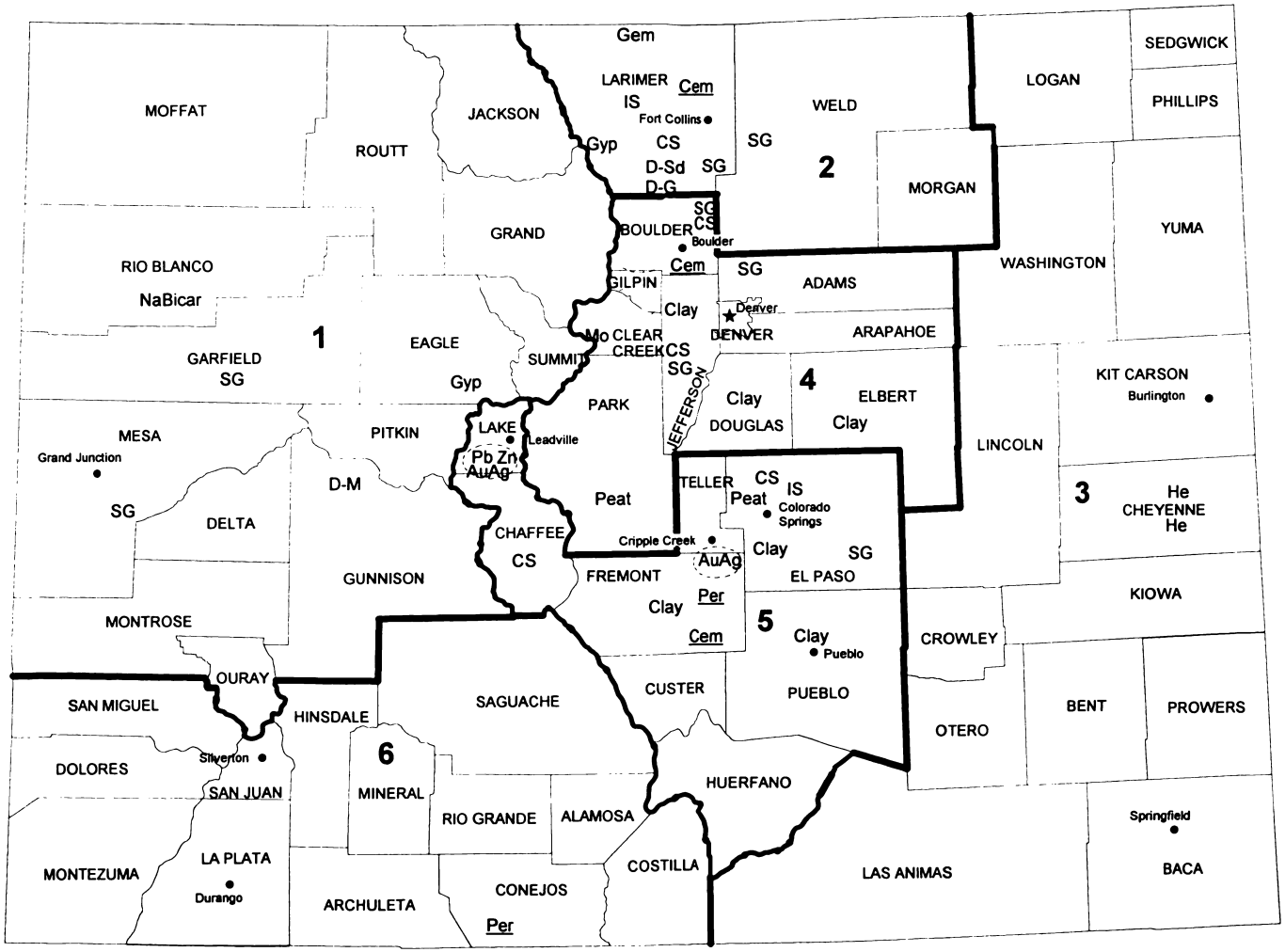
COLORADO



LEGEND

- County boundary
- ★ Capital
- • City
- 1 —— Crushed stone/sand and gravel districts

MINERAL SYMBOLS (Major producing areas)

AuAg	Gold-silver
Cem	Cement plant
Clay	Clay
CS	Crushed stone
D-G	Dimension granite
D-M	Dimension marble
D-Sd	Dimension sandstone
Gem	Gemstones
Gyp	Gypsum
He	Helium
IS	Industrial sand
Mo	Molybdenum
NaBicar	Sodium bicarbonate
Pb	Lead
Peat	Peat
Per	Perlite processing plant
SG	Sand and gravel
Zn	Zinc
⬭	Concentration of mineral operations

0 100 Kilometers

Source: Colorado Geological Survey/U.S. Geological Survey (1998)

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THE MINERAL INDUSTRY OF COLORADO

This chapter has been prepared under a Memorandum of Understanding between the U.S. Geological Survey and the Colorado Geological Survey for collecting information on all nonfuel minerals.

In 1998, the preliminary estimated value[1] of nonfuel mineral production for Colorado was $604 million, according to the U.S. Geological Survey (USGS). This was about a 15% increase from that of 1997,[2] following a 2.1% increase from 1996 to 1997. The State climbed in rank to 23d from 26th among the 50 States in total nonfuel mineral production value, of which Colorado accounted for 1.5% of the U.S. total.

About 66% of Colorado's nonfuel mineral production value came from industrial minerals, especially construction sand and gravel, portland cement, and crushed stone, in descending order of value. Most of the State's remaining nonfuel mineral value resulted from the production of molybdenum, gold, and zinc (descending order of value). In 1998, significant increases in the values of molybdenum, construction sand and gravel, and crushed stone, in descending order of change, plus a moderate increase in portland cement far outweighed moderate and small decreases in the values of gold and zinc, respectively. Most other nonfuel minerals increased in value except silver, lead, and grade-A helium, which showed small decreases, and peat, which remained the same. In 1997, increases in the values of molybdenum, construction sand and gravel, and zinc more than balanced out decreases in gold and crushed stone, resulting in the State's overall rise in value.

Compared with USGS estimates of the quantities produced in the other 49 States during 1998, Colorado remained fifth[2] in lead and sixth in zinc. While the State rose to 7th from 8th in gold, to 8th from 11th in construction sand and gravel, and up to 8th in gemstones (by value), it dropped from 1st to 2d in molybdenum.

[1]The terms "nonfuel mineral production" and related "values" encompass variations in meaning, depending on the minerals or mineral products. Production may be measured by mine shipments, mineral commodity sales, or marketable production (including consumption by producers) as is applicable to the individual mineral commodity.

All 1998 USGS mineral production data published in this chapter are preliminary estimates as of February 1999 and are expected to change. For some mineral commodities (for example, construction sand and gravel, crushed stone, and portland cement), estimates are updated periodically. To obtain the most current information, please contact the appropriate USGS mineral commodity specialist. A telephone listing for the specialists may be retrieved over the Internet at http://minerals.usgs.gov/minerals/contacts/comdir.html; by using MINES FaxBack at (703) 648-4999 from a fax machine with a touch-tone handset (request Document #1000 for a telephone listing of all mineral commodity specialists); or by calling USGS information at (703) 648-4000 for the specialist's name and number. All Mineral Industry Surveys—mineral commodity, State, and country—also may be retrieved over the Internet at http://minerals.usgs.gov/minerals; facsimile copies may be obtained from MINES FaxBack.

[2]Values, percentage calculations, and rankings for 1997 may vary from the *Minerals Yearbook, Area Reports: Domestic 1997, Volume II*, owing to the revision of preliminary 1997 to final 1997 data. Data for 1998 are preliminary and expected to change, while related rankings may also be subject to change.

The following narrative information was provided by the Colorado Geological Survey.[3] The precious metal industry in Colorado produced about 7,430 kilograms (kg) of gold and 12,800 kg of silver in 1997. Production in 1998 will improve slightly to approximately 7,710 kg of gold and an estimated 12,800 kg of silver. Recorded gold production comes from the Cresson Mine in the Cripple Creek district and the Black Cloud Mine in the Leadville district.

Pikes Peak Mining Co. and Golden Cycle Gold Corp. have formed a joint venture called Cripple Creek & Victor Gold Mining Co. It operates the Cresson Mine, which had total proven and probable reserves of 66 million metric tons at a grade of 1 gram of gold per metric ton when it began production in February 1995. Gold production for the Cresson Mine in 1998 was approximately 7,400 kg of gold and 1,500 kg of silver. The value of gold produced at the Cresson Mine based upon $294 per ounce of gold is estimated at $70 million.

In 1998, Cripple Creek & Victor Gold received permission from the Division of Minerals and Geology, the State mining regulatory agency, to expand the size of the existing open pit, dig two additional pits, and enlarge its existing cyanide heap leach pad. The expansion will guarantee ore reserves through 2006.

Because of an increase in the price of silver earlier this year, Sunshine Mining Co. of Boise, ID, is reevaluating its Revenue-Virginius Mine in Ouray County. The Revenue Virginius is estimated to contain about 190 tons of silver with an inferred resource of approximately the same amount.

Base metal production in Colorado, excluding molybdenum, is minor. ASARCO Incorporated produced 800 tons per day of copper-lead-zinc-silver-gold ore from its Black Cloud Mine at Leadville, Lake County. In December 1998, Asarco announced that it would be shutting down production at the Black Cloud Mine, the last producing mine in the Leadville district, ending a 140-year colorful mining history in this part of Colorado. Low commodity prices and exhaustion of reserves at the mine prompted the decision to shut down. In January 1999, over 100 highly paid mine and mill workers were laid off. Asarco continued exploration and maintenance activities at the mine with a much-reduced staff of about 20 people.

The Henderson Mine in Clear Creek County is the Nation's top producer of primary molybdenum ore. In 1998, the mine produced an estimated 16,000 tons of molybdenum concentrate from about 6 million tons of ore, down about 900 tons from that of 1997. The November 1998 price for molybdenum concentrate was $1.55 per pound (Platt's Metal Week). Prices for molybdenum concentrate have slid 50% from the July price of $3.10. The Henderson Mine and mill

[3]James A. Cappa, Chief, Minerals and Mineral Fuels, at the Colorado Geological Survey, authored the text of mineral industry information submitted by that agency.

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employ 460 to 470 people with an annual average salary of $50,000, according to Cyprus Amax Minerals Co.

The Henderson Mine is on track for the year 2000 completion of its "Henderson 2000" modernization program, which includes replacement of the underground train system by a 16-kilometer underground conveyor belt; ore crushing facilities will be moved from the surface at the mill to an underground site at the mine.

American Soda Co. of Glenwood Springs announced plans for a solution-mining venture in order to produce sodium carbonate (soda ash) and sodium bicarbonate from the bedded nahcolite deposits in the Piceance Creek Basin of northwest Colorado. The nearby White River Nahcolite solution mine produces sodium bicarbonate (baking soda) from the same nahcolite deposits.

The remaining $8 million debt on the Yule Marble Quarry near Marble, Gunnison County, famous for its high quality white marble used at the Tomb of the Unknown Soldier in Arlington, VA, and the Lincoln Memorial in Washington, DC, was sold to a private citizen in England. Sales have increased under the guidance of the new management.

Calais Resources of Vancouver purchased the assets of Hendricks Mining Co., which include the Cross Mine and other properties in the Caribou mining district of Boulder County. Recent drilling in the Caribou district has indicated a new gold and silver resource area.

Holman Inc. announced that it is planning a $200 million expansion to its existing cement plant near Florence, CO. The proposed expansion will double the facility's capacity to about 1.5 million tons. Colorado's strong economy and continued growth in residential and commercial construction were the major factors in the expansion decision.

TABLE 1
NONFUEL RAW MINERAL PRODUCTION IN COLORADO 1/ 2/

(Thousand metric tons and thousand dollars unless otherwise specified)

Mineral		1996		1997		1998 p/	
		Quantity	Value	Quantity	Value	Quantity	Value
Clays:							
Bentonite		1	19	--	--	--	--
Common		317	2,320	258	1,970	264	2,010
Kaolin		6	W	--	--	--	--
Gemstones		NA	754	NA	254	NA	770
Lime		W	W	30	1,850	41	2,350
Sand and gravel: Construction		31,600	133,000	32,100	142,000	37,700	172,000
Silver 3/	metric tons	7	1,240	W	W	W	W
Stone:							
Crushed		9,940	64,900	9,720	60,800	12,000	78,900
Dimension	metric tons	23,900	3,330	10,800	3,250	12,500	3,310
Combined values of cement, gold, gypsum (crude), helium (Grade-A), lead, molybdenum, peat, sand and gravel (industrial), zinc, and values indicated by symbol W		XX	308,000	XX	313,000	XX	345,000
Total		XX	513,000	XX	524,000	XX	604,000

p/ Preliminary. NA Not available. W Withheld to avoid disclosing company proprietary data; value included with "Combined values" data. XX Not applicable.

1/ Production as measured by mine shipments, sales, or marketable production (including consumption by producers).

2/ Data are rounded to three significant digits; may not add to totals shown.

3/ Recoverable content of ores, etc.

TABLE 2
COLORADO: CRUSHED STONE SOLD OR USED, BY KIND 1/

Kind	1996				1997			
	Number of quarries	Quantity (thousand metric tons)	Value (thousands)	Unit value	Number of quarries	Quantity (thousand metric tons)	Value (thousands)	Unit value
Limestone	8	2,840	$15,200	$5.35	6	1,790	$11,100	$6.22
Granite	9	5,590	39,500	7.07	6	5,710	38,000	6.66
Sandstone	7 r/	W	W	7.84	5	397	2,900	7.30
Traprock	1	W	W	3.63	1	W	W	3.72
Quartzite	1	W	W	6.75	1	W	W	6.50
Volcanic cinder and scoria	2 r/	W	W	7.08	2	W	W	7.18
Miscellaneous stone	1 r/	W	W	6.29	3	1,440	7,180	5.00
Total	XX	9,940	64,900	6.54	XX	9,720	60,800	6.26

r/ Revised. W Withheld to avoid disclosing company proprietary data; included in "Total." XX Not applicable.

1/ Data are rounded to three significant digits; may not add to totals shown.

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TABLE 3
COLORADO: CRUSHED STONE SOLD OR USED BY PRODUCERS
IN 1997, BY USE 1/ 2/

Use	Quantity (thousand metric tons)	Value (thousands)	Unit value
Coarse aggregate (+1 1/2 inch):			
Riprap and jetty stone	204	$1,190	$5.85
Other coarse aggregate 3/	20	130	6.50
Coarse aggregate, graded:			
Concrete aggregate, coarse	1,120	7,920	7.06
Bituminous aggregate, coarse	645	3,910	6.06
Other graded coarse aggregate 4/	194	1,040	5.35
Fine aggregate (-3/8 inch):			
Stone sand, bituminous mix or seal	733	2,190	2.99
Other fine aggregate 5/	120	645	5.38
Coarse and fine aggregates:			
Graded road base or subbase	782	2,850	3.65
Unpaved road surfacing	19	72	3.79
Terrazzo and exposed aggregate	42	298	7.10
Crusher run or fill or waste	625	907	1.45
Other construction materials 6/	380	2,140	5.62
Agricultural:			
Agricultural limestone	W	W	27.58
Poultry grit and mineral food	W	W	12.88
Chemical and metallurgical; Cement manufacture	837	4,850	5.79
Special:			
Mine dusting or acid water treatment	W	W	27.56
Other fillers or extenders	W	W	28.70
Other miscellaneous uses; Other specified uses not listed	W	W	22.78
Unspecified: 7/			
Actual	2,950	25,200	8.53
Estimated	1,030	7,170	6.95
Total	9,720	60,800	6.26

W Withheld to avoid disclosing company proprietary data; included in "Total."
1/ Includes granite, limestone, miscellaneous stone, quartzite, sandstone, traprock, and volcanic cinder and scoria.
2/ Data are rounded to three significant digits, except unit value; may not add to totals shown.
3/ Includes filter stone.
4/ Includes bituminous surface treatment aggregate and railroad ballast.
5/ Includes stone sand (concrete) and screening (undesignated).
6/ Includes other coarse and fine aggregates.
7/ Includes reported and estimated production without a breakdown by end use.

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TABLE 4
COLORADO: CRUSHED STONE SOLD OR USED BY PRODUCERS IN 1997, BY USE AND DISTRICT 1/ 2/

(Thousand metric tons and thousand dollars)

Use	District 1		District 2		District 4	
	Quantity	Value	Quantity	Value	Quantity	Value
Construction aggregates:						
Coarse aggregate (+1 1/2 inch) 3/	W	W	--	--	78	489
Coarse aggregate, graded 4/	--	--	--	--	W	W
Fine aggregate (-3/8 inch) 5/	W	W	(6/)	(6/)	W	W
Coarse and fine aggregate 7/	W	W	--	--	W	W
Other construction materials	24	158	--	--	3,510	15,500
Agricultural 8/	--	--	--	--	--	--
Chemical and metallurgical 9/	--	--	(6/)	(6/)	(6/)	(6/)
Special 10/	--	--	--	--	--	--
Other miscellaneous use	--	--	--	--	--	--
Unspecified: 11/						
Actual	--	--	--	--	(6/)	(6/)
Estimated	--	--	43	710	236	1,520
Total	24	159	142	1,060	6,600	41,200

Use	District 5		District 6		Unspecified districts	
	Quantity	Value	Quantity	Value	Quantity	Value
Construction aggregates:						
Coarse aggregate (+1 1/2 inch) 3/	W	W	--	--	--	--
Coarse aggregate, graded 4/	W	W	--	--	--	--
Fine aggregate (-3/8 inch) 5/	W	W	--	--	--	--
Coarse and fine aggregate 7/	W	W	(6/)	(6/)	--	--
Other construction materials	1,180	18	--	--	--	--
Agricultural 8/	(6/)	(6/)	--	--	--	--
Chemical and metallurgical 9/	--	--	--	--	--	--
Special 10/	(6/)	(6/)	--	--	--	--
Other miscellaneous use	(6/)	(6/)	--	--	--	--
Unspecified: 11/						
Actual	(6/)	(6/)	(6/)	(6/)	50	338
Estimated	342	2,290	(6/)	(6/)	--	--
Total	2,450	15,100	459	2,950	50	338

W Withheld to avoid disclosing company proprietary data; included with "Other construction materials."
1/ Data are rounded to three significant digits; may not add to totals shown.
2/ No production for District 3.
3/ Includes riprap and jetty stone and other coarse aggregate.
4/ Includes concrete aggregate (coarse), bituminous aggregate (coarse), bituminous surface-treatment aggregate, railroad ballast, and other graded coarse aggregate.
5/ Includes stone sand (concrete), stone sand (bituminous mix or seal), screening (undesignated), and other fine aggregate.
6/ Withheld to avoid disclosing company proprietary data; included in "Total."
7/ Includes graded road base or subbase, terrazzo and exposed aggregate, unpaved road surfacing, and crusher run (select material or fill).
8/ Includes agricultural limestone, poultry grit, and mineral food.
9/ Includes cement and lime manufacture.
10/ Includes mine dusting or acid water treatment and other fillers or extenders.
11/ Includes reported and estimated production without a breakdown by end use.

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TABLE 5

COLORADO: CONSTRUCTION SAND AND GRAVEL SOLD OR USED IN 1997,
BY MAJOR USE CATEGORY 1/

Use	Quantity (thousand metric tons)	Value (thousands)	Value per ton
Concrete aggregate (including concrete sand)	4,310	$20,900	$4.85
Plaster and gunite sands	86	917	10.66
Concrete products (blocks, bricks, pipe, decorative, etc.)	80	431	5.39
Asphaltic concrete aggregates and other bituminous mixtures	1,610	8,130	5.06
Road base and coverings 2/	4,530	17,400	3.85
Fill	1,050	2,750	2.61
Snow and ice control	46	302	6.57
Other miscellaneous uses 3/	109	550	5.05
Unspecified: 4/			
Actual	12,100	53,900	4.46
Estimated	8,150	36,900	4.53
Total or average	32,100	142,000	4.43

1/ Data are rounded to three significant digits, except value per ton; may not add to totals shown.
2/ Includes road and other stabilization (cement and lime).
3/ Includes filtration and railroad ballast.
4/ Includes reported and estimated production without a breakdown by end use.

TABLE 6
COLORADO: CONSTRUCTION SAND AND GRAVEL SOLD OR USED IN 1997,
BY USE AND DISTRICT 1/

(Thousand metric tons and thousand dollars)

Use	District 1		District 2		District 3	
	Quantity	Value	Quantity	Value	Quantity	Value
Concrete aggregate and concrete products 2/	482	2,840	1,540	6,940	51	179
Asphaltic concrete aggregates and road base materials 3/	2,480	8,890	1,920	7,070	578	1,850
Other miscellaneous uses 4/	W	W	31	185	--	--
Unspecified: 5/						
Actual	W	W	2,040	8,330	135	1,040
Estimated	2,370	13,200	1,020	4,070	23	58
Total	7,920	36,000	6,550	26,600	788	3,120

Use	District 4		District 5		District 6	
	Quantity	Value	Quantity	Value	Quantity	Value
Concrete aggregate and concrete products 2/	1,690	9,570	618	1,980	95	731
Asphaltic concrete aggregates and road base materials 3/	869	4,520	300	931	1,030	5,360
Other miscellaneous uses 4/	6	37	W	W	W	W
Unspecified: 5/						
Actual	5,320	23,700	W	W	W	W
Estimated	2,440	9,480	858	3,880	1,440	6,170
Total	10,300	47,300	3,670	16,000	2,830	13,100

W Withheld to avoid disclosing company proprietary data; included in "Total."
1/ Data are rounded to three significant digits; may not add to totals shown.
2/ Includes plaster and gunite sands.
3/ Includes fill, road and other stabilization (cement and lime), and snow and ice control.
4/ Includes filtration and railroad ballast.
5/ Includes reported and estimated production without a breakdown by end use.

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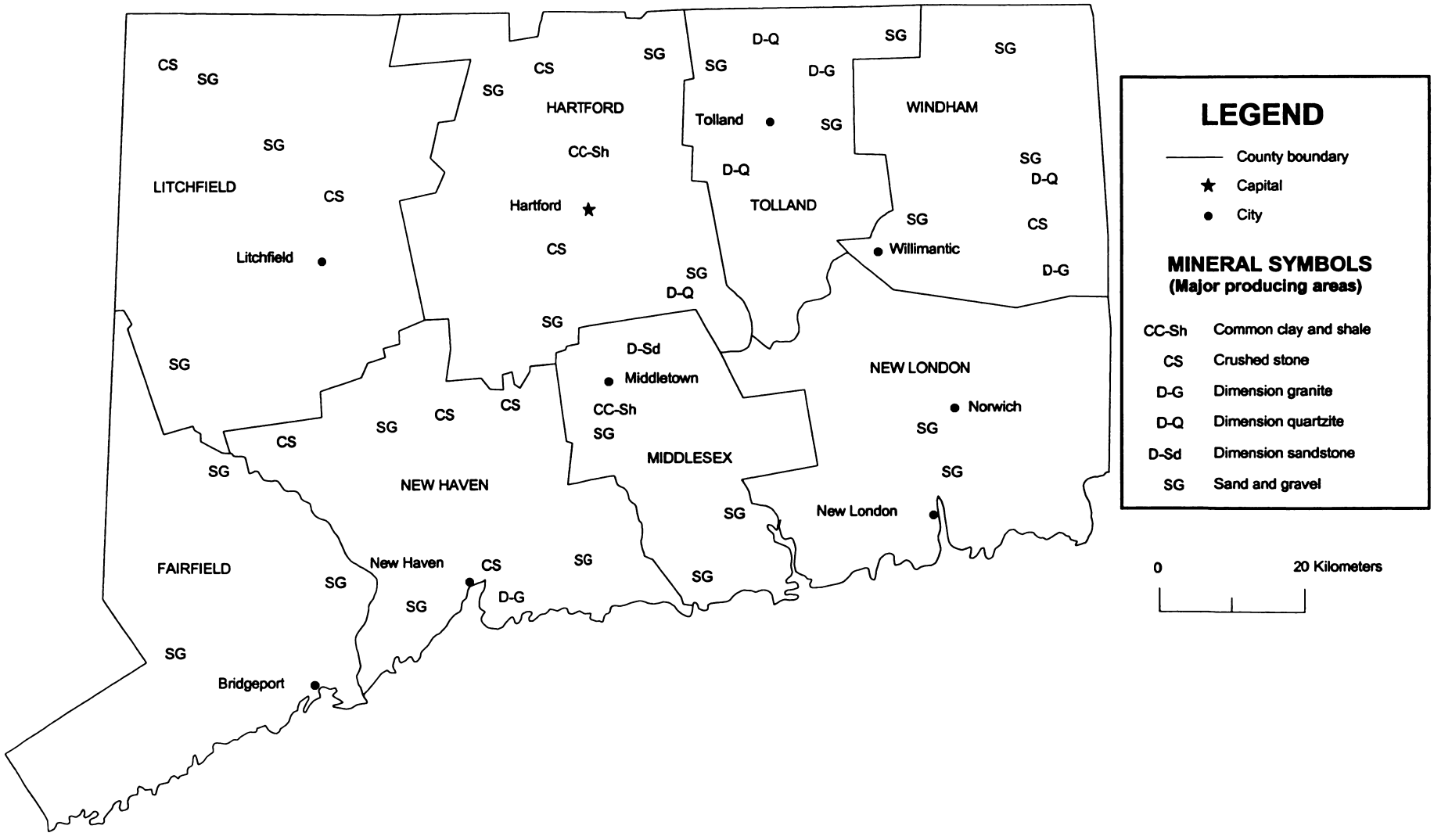
CONNECTICUT



LEGEND

- County boundary
- ★ Capital
- ● City

MINERAL SYMBOLS
(Major producing areas)

CC-Sh	Common clay and shale
CS	Crushed stone
D-G	Dimension granite
D-Q	Dimension quartzite
D-Sd	Dimension sandstone
SG	Sand and gravel

Source: Connecticut Geological and Natural History Survey/U.S. Geological Survey (1998)

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THE MINERAL INDUSTRY OF CONNECTICUT

This chapter has been prepared under a Memorandum of Understanding between the U.S. Geological Survey and the Connecticut Geological and Natural History Survey for collecting information on all nonfuel minerals.

In 1998, the preliminary estimated value[1] of nonfuel mineral production for Connecticut was $105 million, according to the U.S. Geological Survey (USGS). This was a 31% increase from that of 1997,[2] and followed a 2% decrease from 1996 to 1997. Crushed stone and construction sand and gravel, the leading nonfuel mineral commodities by value, accounted for nearly all of the State's total nonfuel mineral production and value. In 1998, Connecticut's increase in value resulted from a $17.7 million increase in crushed stone and a $6.8 million rise in construction sand and gravel (table 1). The value of dimension stone showed a small decrease, and the values of common clays and gemstones remained unchanged.

The Connecticut Geological and Natural History Survey (CGNHS) provided the following narrative information.[3] Although no new large construction projects were begun in Connecticut during 1998, overall increases in construction industry work (about a 15% increase in building construction), especially for highway construction projects, caused increased production of construction sand and gravel and crushed stone, according to the CGNHS and the Connecticut Construction Industry Association (table 1). In June 1998, the U.S. Congress passed into law the Transportation Equity Act for the 21st Century (Public Law 105-178), which authorized funds for Federal-aid highways, highway safety programs, and transit programs. This resulted in more Federal money for road and bridge construction in the State.

[1]The terms "nonfuel mineral production" and related "values" encompass variations in meaning, depending on the minerals or mineral products. Production may be measured by mine shipments, mineral commodity sales, or marketable production (including consumption by producers) as is applicable to the individual mineral commodity.

All 1998 USGS mineral production data published in this chapter are preliminary estimates as of February 1999 and are expected to change. For some mineral commodities (for example, construction sand and gravel, crushed stone, and portland cement), estimates are updated periodically. To obtain the most current information, please contact the appropriate USGS mineral commodity specialist. A telephone listing for the specialists may be retrieved over the Internet at http://minerals.usgs.gov/minerals/contacts/comdir.html; by using MINES FaxBack at (703) 648-4999 from a fax machine with a touch-tone handset (request Document #1000 for a telephone listing of all mineral commodity specialists); or by calling USGS information at (703) 648-4000 for the specialist's name and number. All Mineral Industry Surveys—mineral commodity, State, and country—also may be retrieved over the Internet at http://minerals.usgs.gov/minerals; facsimile copies may be obtained from MINES FaxBack.

[2]Values, percentage calculations, and rankings for 1997 may vary from the *Minerals Yearbook, Area Reports: Domestic 1997, Volume II*, owing to the revision of preliminary 1997 to final 1997 data. Data for 1998 are preliminary and expected to change, while related rankings may also be subject to change.

[3]Nancy McHone, Environmental Analyst, submitted the information provided by the CGNHS.

TABLE 1
NONFUEL RAW MINERAL PRODUCTION IN CONNECTICUT 1/ 2/

(Thousand metric tons and thousand dollars unless otherwise specified)

	1996		1997		1998 p/	
Mineral	Quantity	Value	Quantity	Value	Quantity	Value
Clays: Common	W	W	48	90	49	92
Gemstones	NA	5	NA	5	NA	5
Sand and gravel: Construction	6,380	26,900	5,410	24,800	6,710	31,600
Stone: Crushed	6,720	55,000	5,760	55,300	7,300	73,000
Total 3/	XX	81,900	XX	80,200	XX	105,000

p/ Preliminary. NA Not available. W Withheld to avoid disclosing company proprietary data. XX Not applicable.
1/ Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
2/ Data are rounded to three significant digits; may not add to totals shown.
3/ Partial total, excludes values that must be concealed to avoid disclosing company proprietary data.

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TABLE 2
CONNECTICUT: CRUSHED STONE SOLD OR USED, BY KIND 1/

Kind	1996 Number of quarries	1996 Quantity (thousand metric tons)	1996 Value (thousands)	1996 Unit value	1997 Number of quarries	1997 Quantity (thousand metric tons)	1997 Value (thousands)	1997 Unit value
Limestone	5 r/	1,010 r/	7,490 r/	$7.44 r/	4	W	W	$7.65
Dolomite	2 r/	W	W	13.44	2	W	W	23.89
Granite	6	144	1,110	7.70	4	158	1,250	7.89
Traprock	9 r/	4,590 r/	33,600 r/	7.31	8	4,180	35,000	8.37
Quartzite	1	W	W	4.35	1	W	W	4.52
Miscellaneous stone	2 r/	W	W	14.32	2	W	W	14.65
Total	XX	6,720	55,000	8.19	XX	5,760	55,300	9.60

r/ Revised. W Withheld to avoid disclosing company proprietary data; included in "Total." XX Not applicable.
1/ Data are rounded to three significant digits, except unit value; may not add to totals shown.

TABLE 3
CONNECTICUT: CRUSHED STONE SOLD OR USED BY PRODUCERS
IN 1997, BY USE 1/ 2/

Use	Quantity (thousand metric tons)	Value (thousands)	Unit Value
Coarse aggregate (+1 inch): Other coarse aggregate 3/	11	$82	$7.45
Coarse aggregate, graded: Other graded coarse aggregate 4/	231	2,140	9.27
Fine aggregate (-3/8 inch) 5/	256	1,970	7.70
Coarse and fine aggregates:			
Graded road base or subbase	47	347	7.38
Unpaved road surfacing	27	206	7.63
Crusher run or fill or waste	5	35	7.00
Agricultural limestone	50	476	9.52
Special:			
Asphalt fillers or extenders	W	W	12.96
Other fillers or extenders	W	W	27.65
Unspecified: 6/			
Actual	1,440	11,400	7.96
Estimated	3,270	27,500	8.43
Total	5,760	55,300	9.60

W Withheld to avoid disclosing company proprietary data; included in "Total."
1/ Includes dolomite, granite, limestone, miscellaneous stone, quartzite, and traprock.
2/ Data are rounded to three significant digits, except unit value; may not add to totals
3/ Includes riprap and jetty stone.
4/ Includes bituminous aggregate (coarse), bituminous surface-treatment aggregate, and concrete aggregate (coarse).
5/ Includes stone sand, bituminous mix or seal, and screening (undesignated).
6/ Includes reported and estimated production without a breakdown by end use.

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TABLE 4
CONNECTICUT: CRUSHED STONE SOLD OR USED
BY PRODUCERS IN 1997, BY USE 1/

(Thousand metric tons and thousand dollars)

Use	District 1	
	Quantity	Value
Construction aggregates:		
Coarse aggregate (+1 1/2 inch) 2/	W	W
Coarse aggregate, graded 3/	W	W
Fine aggregate (-3/8 inch) 4/	W	W
Coarse and fine aggregate 5/	W	W
Agricultural 6/	50	476
Special 7/	W	W
Unspecified: 8/		
Actual	W	W
Estimated	W	W
Total	5,760	55,300

W Withheld to avoid disclosing company proprietary data; included in "Total."
1/ Data are rounded to three significant digits; may not add to totals shown.
2/ Includes riprap and jetty stone and other coarse aggregate.
3/ Includes concrete aggregate (coarse), bituminous aggregate (coarse), Bituminous surface treatment aggregate, and other graded coarse aggregate.
4/ Includes stone sand (bituminous mix or seal), and screening
5/ Includes graded road base or subbase, unpaved road surfacing, and crusher run (select material or fill).
6/ Includes agricultural limestone.
7/ Includes asphalt fillers or extenders and other fillers or extenders.
8/ Includes reported and estimated production without a breakdown by end

TABLE 5
CONNECTICUT: CONSTRUCTION SAND AND GRAVEL SOLD OR USED IN 1997,
BY MAJOR USE CATEGORY 1/ 2/

Use	Quantity (thousand metric tons)	Value (thousands)	Value per ton
Concrete aggregate and concrete products 3/	1,340	$7,200	$5.37
Asphaltic concrete aggregates and other bituminous mixtures	236	1,460	6.19
Road base and coverings	669	4,600	6.88
Fill	246	928	3.77
Snow and ice control	237	1,440	6.09
Other miscellaneous uses	15	36	2.40
Unspecified: 4/			
Actual	659	2,070	3.15
Estimated	2,020	7,020	3.48
Total or average	5,410	24,800	4.57

1/ To avoid disclosing company proprietary data, no district tables were produced for 1997.
2/ Data are rounded to three significant digits; may not add to totals shown.
3/ Includes plaster and gunite sands.
4/ Includes reported and estimated production without a breakdown by end use.

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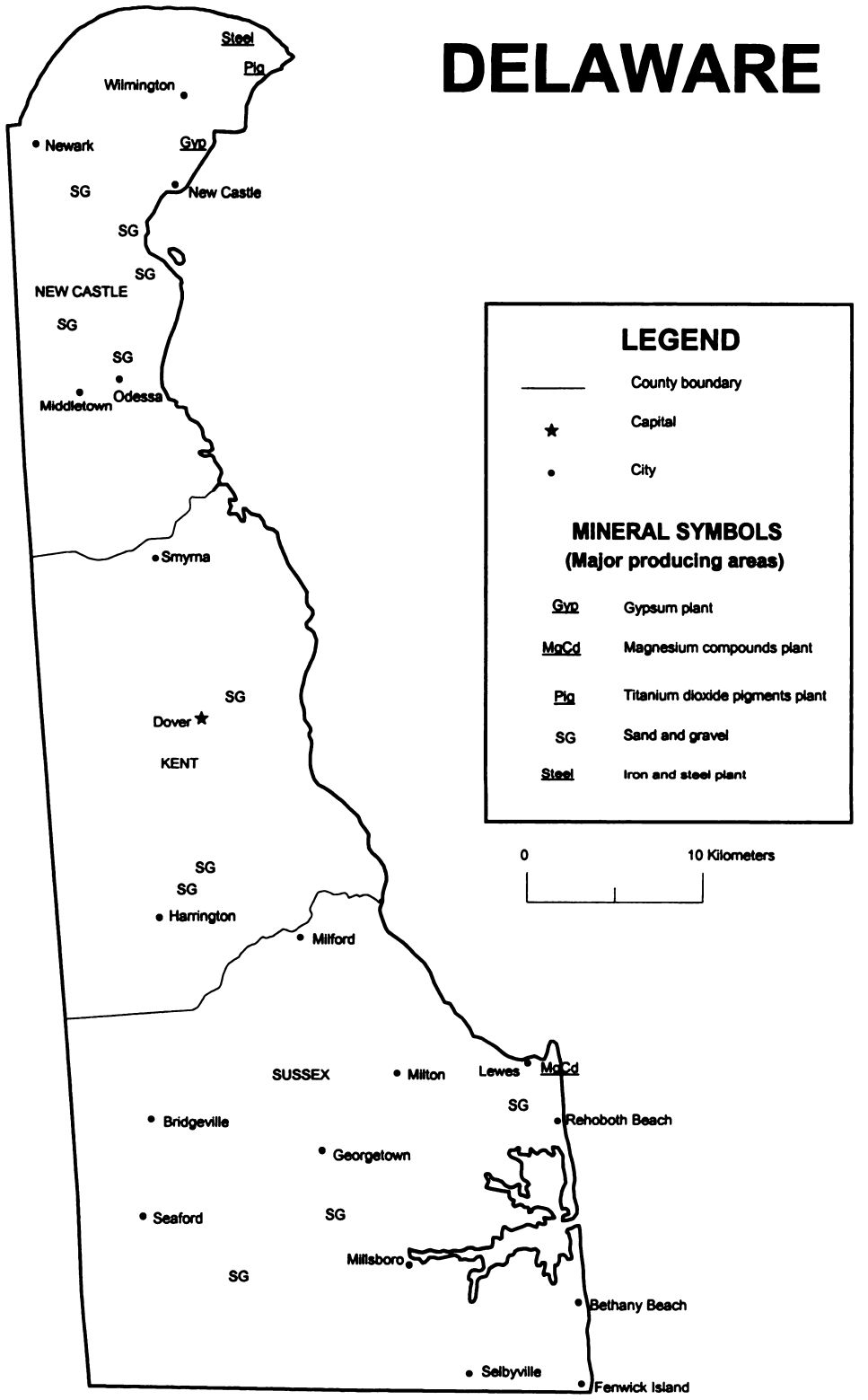
DELAWARE



Source: Delaware Geological Survey/U.S. Geological Survey (1998)

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THE MINERAL INDUSTRY OF DELAWARE

This chapter has been prepared under a Memorandum of Understanding between the U.S. Geological Survey and the Delaware Geological Survey for collecting information on all nonfuel minerals.

In 1998, Delaware's preliminary estimated value[1] of nonfuel mineral production was $11.2 million, according to the U.S. Geological Survey (USGS). This was a decrease of about $1.2 million from that of 1997,[2] and followed about a $6 million increase from 1996 to 1997. Because magnesium compound production data are withheld to avoid disclosing company proprietary data, the State's actual total values are higher than those shown in table 1.

In 1998, construction sand and gravel and magnesium compounds showed small decreases in value. During 1997, however, construction sand and gravel value significantly increased (table 1) and the value of magnesium compounds rose slightly. The value of gemstones was the result of collecting done by hobbyists and was estimated to have remained the same. Delaware ranked fifth[2] of the six States in the quantity of magnesium compounds produced. Magnesium compounds were extracted from seawater close to the mouth of the Delaware Bay, near Lewes, Sussex County, for use in the manufacture of chemical and pharmaceutical products.

The Delaware Geological Survey[3] (DGS) completed the digital portion of the States' topographic mapping project, as part of an innovative partnership agreement with the USGS and a private vendor. The eight digital layers became available in 1998 on CD-ROM from the DGS and are also available through the DGS web site. The digital layers complement the 1:24,000 quadrangle topographic maps (paper copies) that became available in 1993. The U.S. Department of the Interior's Minerals Management Service continued to provide support for studies characterizing offshore sand resources in both State and Federal waters for possible use in beach replenishment. The DGS is currently evaluating sediment characteristics of samples collected from an offshore coring program and is providing technical support for an offshore environmental assessment program in selected localities.

[1]The terms "nonfuel mineral production" and related "values" encompass variations in meaning, depending on the minerals or mineral products. Production may be measured by mine shipments, mineral commodity sales, or marketable production (including consumption by producers) as is applicable to the individual mineral commodity.

All 1998 USGS mineral production data published in this chapter are preliminary estimates as of February 1999 and are expected to change. Construction sand and gravel estimates are updated periodically. To obtain the most current information, please contact the appropriate USGS mineral commodity specialist. A telephone listing for the specialists may be retrieved over the Internet at http://minerals.usgs.gov/minerals/contacts/comdir.html; by using MINES FaxBack at (703) 648-4999 from a fax machine with a touch-tone handset (request Document #1000 for a telephone listing of all mineral commodity specialists); or by calling USGS information at (703) 648-4000 for the specialist's name and number. All Mineral Industry Surveys–mineral commodity, State, and country–also may be retrieved over the Internet at http://minerals.usgs.gov/minerals; facsimile copies may be obtained from MINES FaxBack.

[2]Values, percentage calculations, and rankings for 1997 may vary from the *Minerals Yearbook, Area Reports: Domestic 1997, Volume II*, owing to the revision of preliminary 1997 to final 1997 data. Data for 1998 are preliminary and expected to change, while related rankings may also be subject to change.

[3]John H. Talley, Associate Director, authored the text of State minerals information provided by the Delaware Geological Survey.

TABLE 1
NONFUEL RAW MINERAL PRODUCTION IN DELAWARE 1/ 2/

(Thousand metric tons and thousand dollars unless otherwise specified)

	1996		1997		1998 p/	
Mineral	Quantity	Value	Quantity	Value	Quantity	Value
Gemstones	NA	1	NA	1	NA	1
Sand and gravel: Construction	2,370	6,820	2,540	12,40	2,240	11,200
Total 3/	XX	6,820	XX	12,40	XX	11,200

p/ Preliminary. NA Not available. XX Not applicable.
1/ Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
2/ Data are rounded to three significant digits; may not add to totals shown.
3/ Partial total, excludes values which must be concealed to avoid disclosing company proprietary data.

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TABLE 2
DELAWARE: CONSTRUCTION SAND AND GRAVEL SOLD OR USED IN 1997,
BY MAJOR USE CATEGORY 1/ 2/

Use	Quantity (thousand metric tons)	Value (thousands)	Value per ton
Concrete aggregate (including concrete sand)	1,340	$6,940	$5.19
Plaster and gunite sands	130	775	5.96
Road base and coverings	61	560	9.18
Other miscellaneous uses 3/	1,010	4,060	4.04
Unspecified: Actual 4/	8	23	2.88
Total or average	2,540	12,400	4.87

1/ To avoid disclosing company proprietary data, no district tables were produced for 1997.
2/ Data are rounded to three significant digits; may not add to totals shown.
3/ Includes fill, railroad ballast, and snow and ice control.
4/ Includes reported production without a breakdown by end use.

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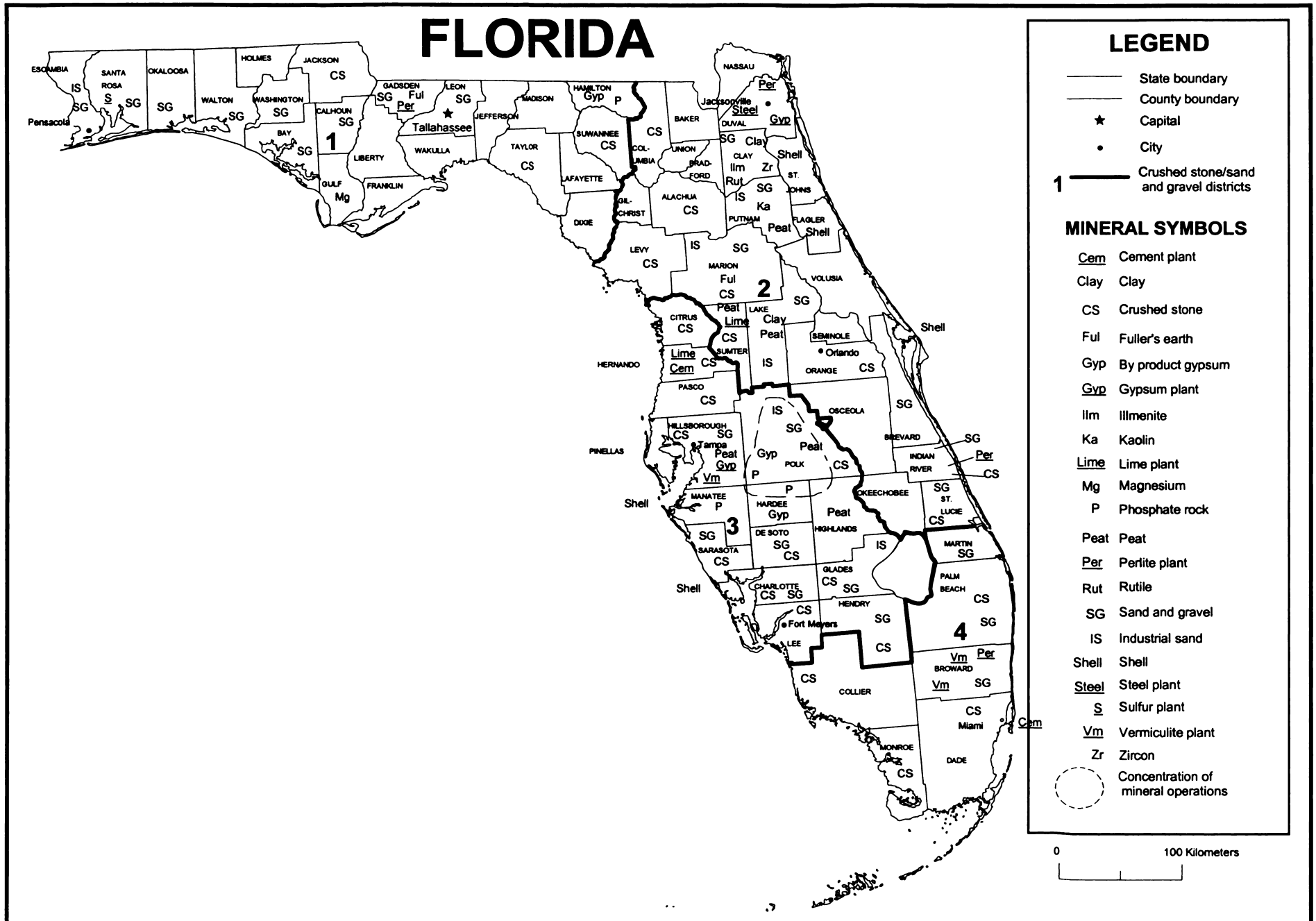

Source: Florida Geological Survey/U.S. Geological Survey (1998)

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THE MINERAL INDUSTRY OF FLORIDA

This chapter has been prepared under a Memorandum of Understanding between the U.S. Geological Survey and the Florida Geological Survey for collecting information on all nonfuel minerals.

In 1998, the preliminary estimated value[1] of nonfuel mineral production for Florida was about $1.96 billion, according to the U.S. Geological Survey (USGS). This value, the highest nonfuel mineral value reported in the State's history, was a 7% increase from that of 1997,[2] and followed a 4% increase in 1997 from 1996. The increase continued an upward trend that began in 1994, following 5 years of lowering values. For the third consecutive year, Florida ranked fourth among the 50 States in total nonfuel mineral production value, of which the State accounted for almost 5% of the U.S. total.

Florida continued to be the Nation's leading phosphate rock-mining State in 1998, producing nearly seven times the quantity of material as that of the next-highest State. Phosphate rock is only produced in four States. In terms of value, phosphate rock, crushed stone, and portland cement continued to be the most important minerals produced in Florida. In 1998, increases of $53 million in the value of crushed stone, $44 million in phosphate rock, and $16 million in portland cement led the State's increase in value (table 1). This was further supported by smaller increases in construction sand and gravel, zircon concentrates, rutile, masonry cement, and peat, in descending order of net increase. Values of production for all other mineral commodities also increased except for staurolite and kaolin, which showed small decreases, and gemstones, which remained unchanged.

Likewise, in 1997, most of Florida's nonfuel mineral commodities increased in value, led by portland cement up $29 million (up nearly 12%), zircon concentrates up $15.5 million, phosphate rock almost $10 million, and construction sand and gravel up $6.7 million (almost 10%).

Based on USGS preliminary estimates of the quantities produced in the 50 States in 1998, Florida remained the only[2] State to produce rutile and staurolite. It ranked first in peat and tied for first in masonry cement; third in fuller's earth and crushed stone; fourth in magnesium compounds; and seventh in portland cement. Florida ranked the first of three titanium-producing States and the first of two States in zirconium concentrates. Additionally, Florida produced substantial quantities of construction and industrial sand and gravel.

The Florida Geological Survey[3] provided the following narrative information. Common clay is extracted from many localities in Florida. Fuller's earth is Florida's number one clay commodity because it surpasses both of Florida's other two clay types, common clay and kaolin, in total quantity produced and total mineral production value. Fuller's earth, in the form of palygorskite (attapulgite), is mined by the Engelhard Corp. and the Milwhite Co. in Gadsden County, and, in the form of montmorillonite, is mined by MFM Industries, Inc. in Marion County. Kaolin is mined by the Feldspar Corp. in Putnam County.

The principal use of the heavy minerals in Florida remains the manufacture of titanium dioxide pigments. RGC (USA) Mineral Sands, Inc. (RGC) and E.I. du Pont de Nemours and Co., Inc. remain the only heavy mineral producers in the State. In 1997, RGC began mining operations in Putnam County.

Florida's phosphate producers supply approximately 25% of the world's and 75% of the Nation's phosphate needs. As such, it is Florida's largest industrial mineral commodity in terms of quantity produced and production value. Companies that actively mined phosphate during 1998 include IMC-Agrico Co., Cargill Fertilizer, Inc., CF Industries, Inc., Potash Corp. of Saskatchewan and Agrifos L.L.C. NuGulf Industries reopened its mine in late November. IMC-Agrico announced the temporary shut down of the Kingsford and Payne Creek Mines and the Clear Springs and Noralyn Mines will be closed permanently in mid-1999.

IMC-Agrico Co. and Farmland Hydro LP are currently trying to get approval to mine on about 25,000 hectares in DeSoto, Hardee, and Manatee Counties. This region falls into the Peace River Basin.

Florida Rock Industries (FRI) has received permits that will allow them to complete construction of its cement plant at Newberry, FL. Nearby, in the Branford area, the Suwannee American Cement Co., a subsidiary of Anderson-Columbia Co., has applied for air permits for a new cement plant. If both companies begin production it would bring the total number of cement plants in Florida to six (Matus, 1998).

E.R. Jahna Industries is now in the permitting phase on a proposed sand mine in northern Polk County.

Limestone ($CaCO_3$), the primary source of stone in Florida and one with large reserves, is mined in many localities. Much of the limestone is crushed and used as base course material or as small aggregate in road building. The larger size limestone aggregates are becoming a limited resource in the State.

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[1]The terms "nonfuel mineral production" and related "values" encompass variations in meaning, depending on the minerals or mineral products. Production may be measured by mine shipments, mineral commodity sales, or marketable production (including consumption by producers) as is applicable to the individual mineral commodity.

All 1998 USGS mineral production data published in this chapter are preliminary estimates as of February 1999 and are expected to change. For some mineral commodities (for example, construction sand and gravel, crushed stone, and portland cement), estimates are updated periodically. To obtain the most current information, please contact the appropriate USGS mineral commodity specialist. A telephone listing for the specialists may be retrieved over the Internet at http://minerals.usgs.gov/minerals/contacts/comdir.html; by using MINES FaxBack at (703) 648-4999 from a fax machine with a touch-tone handset (request Document #1000 for a telephone listing of all mineral commodity specialists); or by calling USGS information at (703) 648-4000 for the specialist's name and number. All Mineral Industry Surveys–mineral commodity, State, and country–also may be retrieved over the Internet at http://minerals.usgs.gov/minerals; facsimile copies may be obtained from MINES FaxBack.

[2]Values, percentage calculations, and rankings for 1997 may vary from the *Minerals Yearbook, Area Reports: Domestic 1997, Volume II*, owing to the revision of preliminary 1997 to final 1997 data. Data for 1998 are preliminary and expected to change, while related rankings may also be subject to change.

[3]Steven Spencer, Coastal/Economic Geologist, authored the text submitted by the Florida Geological Survey.

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FRI's request for a 10-year extension to its mining lease in the Withlachoochee State Forest was turned down in 1998 by the U.S. Forest Service (USFS). FRI was first issued a mining lease by the USFS in 1965. The action by the USFS brings limestone mining in the Withlachoochee State Forest to an end (Hollingsworth, 1998).

The Quality Control 2000 program for qualifying laboratories and training technicians who sample and test aggregates, asphalt, concrete, and earthwork is moving forward on schedule. This program is a result of the Federal Highway Administration's mandate that all State's Departments of Transportation have Quality Assurance Procedures for Construction in place by June 30, 2000. The University of Florida is acting as coordinator for the Florida Department of Transportation in developing and administering the program.

The Florida Minerals Association (FMA) was established by several Florida mining companies in 1997 to provide leadership and to advance and encourage responsible development of the mineral industry in the State. The FMA generally focuses on legislation and regulation, the environment, public safety and health, and land use issues. The association is in the process of selecting a director and building an internet web page.

The Department of Environmental Protection's (DEP) Bureau of Mine Regulation (BOMR) administers the State's reclamation rules, which are found in the Florida Administrative Code and which are authorized by Chapter 373 of the Florida Statutes. The BOMR regulates the permitting of mines that are located on lands over which the DEP has jurisdiction through DEP's dredge and fill and environmental resource permitting rules. The BOMR also regulates the design, construction, and maintenance of phosphogypsum recovery stack systems.

In 1998, the BOMR coordinated the National Association of State Land Reclamationists conference, where several mines were recognized with awards for their reclamation efforts. The BOMR published a document recently that outlines an integrated habitat network for the Florida phosphate district (Jim Price, FDEP-BOMR, written commun., 1999).

Miami-Dade Lake Belt Plan legislation was vetoed in the 1998 legislature. The veto took place not because of the plan itself, but rather because of another provision that was attached to the bill. The bill will be reintroduced into the 1999 legislature. The plan integrates mining operations with other land uses. The plan calls for operators to contribute to a trust fund that will, in turn, handle all wetlands mitigation. Federal, State, and local permitting and reclamation will be consolidated at the county level.

References Cited

Hollingsworth, Jan, 1998, Mistake allowed mining in state forest: Tampa Tribune, November 24.

Matus, Ron, 1998, Cement plant is approved: Gainesville Sun, December 17, p. 1B and 3B.

TABLE 1
NONFUEL RAW MINERAL PRODUCTION IN FLORIDA 1/ 2/

(Thousand metric tons and thousand dollars unless otherwise specified)

Mineral	1996		1997		1998 p/	
	Quantity	Value	Quantity	Value	Quantity	Value
Cement:						
Masonry	422	35,200 e/	406	36,200 e/	413	38,100
Portland	3,450	245,000 e/	3,750	274,000 e/	3,880	290,000
Clays:						
Fuller's earth	377	58,900	W	W	W	W
Kaolin	35	3,760	W	W	W	W
Gemstones	NA	1	NA	1	NA	1
Peat	298	5,550	361	5,710	263	7,160
Sand and gravel:						
Construction	18,500	68,800	19,200	75,500	20,100	81,200
Industrial	515	6,340	507	5,800	536	6,220
Stone: Crushed 3/	73,600	394,000	73,800	396,000	81,700	449,000
Combined values of clays (common), magnesium compounds, phosphate rock, staurolite, stone [crushed marl (1996-97)], titanium concentrates, zirconium concentrates, and values indicated by symbol W	XX	947,000	XX	1,040,000	XX	1,090,000
Total	XX	1,760,000	XX	1,830,000	XX	1,960,000

e/ Estimated. p/ Preliminary. NA Not available. W Withheld to avoid disclosing company proprietary data; value included with "Combined values" data. XX Not applicable.

1/ Production as measured by mine shipments, sales, or marketable production (including consumption by producers).

2/ Data are rounded to three significant digits; may not add to totals shown.

3/ Excludes certain stones; kind and value included with "Combined values" data.

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TABLE 2
FLORIDA: CRUSHED STONE SOLD OR USED, BY KIND 1/

Kind	1996 Number of quarries	1996 Quantity (thousand metric tons)	1996 Value (thousands)	1996 Unit value	1997 Number of Quarries	1997 Quantity (thousand metric tons)	1997 Value (thousands)	1997 Unit value
Limestone	76 2/	71,000 2/	$379,000 2/	$5.34 2/	73 2/	71,600 2/	$384,000 2/	$5.37 2/
Dolomite	4	W	W	6.55	4	W	W	6.42
Shell	4	W	W	4.46	4	W	W	4.61
Calcareous marl	2	(3/)	(3/)	(3/)	1	(3/)	(3/)	(3/)
Total	XX	73,600	394,000	5.35	XX	73,800	396,000	5.37

W Withheld to avoid disclosing company proprietary data; included in "Total." XX Not applicable.
1/ Data are rounded to three significant digits; may not add to totals shown.
2/ Includes "limestone-dolomite" reported with no distinction between the two.
3/ Excludes calcareous marl from State total to avoid disclosing company proprietary data.

TABLE 3
FLORIDA: CRUSHED STONE SOLD OR USED BY PRODUCERS
IN 1997, BY USE 1/ 2/

Use	Quantity (thousand metric tons)	Value (thousands)	Unit value
Coarse aggregate (+1 1/2 inch):			
Riprap and jetty stone	3,530	$4,560	$1.29
Other coarse aggregate 3/	30	240	8.00
Coarse aggregate, graded:			
Concrete aggregate, coarse	5,750	36,100	6.27
Bituminous aggregate, coarse	2,860	15,700	5.49
Other graded coarse aggregate 4/	1,710	12,900	7.55
Fine aggregate (-3/8 inch):			
Stone sand, concrete	1,690	9,530	5.64
Stone sand, bituminous mix or seal	2,120	9,980	4.71
Screening, undesignated	2,380	8,020	3.36
Other fine aggregates	1,560	9,220	5.92
Coarse and fine aggregates:			
Graded road base or subbase	13,900	44,000	3.16
Unpaved road surfacing	307	1,430	4.64
Crusher run or fill or waste	3,550	10,200	2.88
Other coarse and fine aggregates	430	3,260	7.58
Other construction materials	2	10	5.00
Agricultural:			
Agricultural limestone	485	3,070	6.33
Other agricultural uses	200	885	4.43
Chemical and metallurgical, cement manufacture	W	W	1.45
Special, other specified uses not listed	W	W	2.24
Unspecified: 5/			
Actual	27,500	204,000	7.39
Estimated	3,670	20,800	5.66
Total	73,800	396,000	5.37

W Withheld to avoid disclosing company proprietary data; included in "Total."
1/ Includes dolomite, limestone, limestone-dolomite, and shell; excludes calcareous marl from State to avoid disclosing company proprietary data.
2/ Data are rounded to three significant digits; may not add to totals shown.
3/ Includes filter stone.
4/ Includes railroad ballast.
5/ Includes reported and estimated production without a breakdown by end use.

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TABLE 4
FLORIDA: CRUSHED STONE SOLD OR USED BY PRODUCERS IN 1997,
BY USE AND DISTRICT 1/ 2/

(Thousand metric tons and thousand dollars)

Use	District 1		District 2		District 3		District 4	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
Construction aggregates:								
Coarse aggregate (+1 1/2 inch) 3/	W	W	W	W	W	W	W	W
Coarse aggregate, graded 4/	W	W	W	W	4,950	34,400	4,660	22,500
Fine aggregate (-3/8 inch) 5/	W	W	W	W	4,120	18,700	3,370	16,100
Coarse and fine aggregate 6/	W	W	6,790	21,800	2,990	11,300	7,530	19,600
Other construction materials	--	--	W	W	--	--	--	--
Agricultural 7/	221	1,520	W	W	347	2,120	--	--
Chemical and metallurgical 8/	--	--	--	--	W	W	--	--
Other miscellaneous uses 9/	--	--	W	W	--	--	--	--
Unspecified: 10/								
Actual	W	W	W	W	W	W	W	W
Estimated	--	--	1,150	6,870	848	4,820	W	W
Total	2,340	16,500	9,130	36,600	22,000	129,000	40,400	214,000

W Withheld to avoid disclosing company proprietary data; included in "Total."
1/ Excludes calcareous marl from State to avoid disclosing company proprietary data.
2/ Data are rounded to three significant digits; may not add to totals shown.
3/ Includes filter stone and riprap and jetty stone, and other coarse aggregate.
4/ Includes concrete aggregate (coarse), bituminous aggregate (coarse), railroad ballast, and other graded coarse aggregate.
5/ Includes stone sand (concrete), stone sand (bituminous mix or seal), screening (undesignated), and other fine aggregate.
6/ Includes graded road base or subbase, unpaved road surfacing, crusher run (select material or fill), and other coarse and fine aggregates.
7/ Includes agricultural limestone, and other agricultural uses.
8/ Includes cement manufacture.
9/ Includes other specified uses not listed.
10/ Includes reported and estimated production without a breakdown by end use.

TABLE 5
FLORIDA: CONSTRUCTION SAND AND GRAVEL SOLD OR USED IN 1997,
BY MAJOR USE CATEGORY 1/

Use	Quantity (thousand metric tons)	Value (thousands)	Value per ton
Concrete aggregate (including concrete sand)	5,720	$24,500	$4.28
Plaster and gunite sands	774	3,000	3.87
Concrete products (blocks, bricks, pipe, decorative, etc.)	533	2,980	5.59
Asphaltic concrete aggregates and other bituminous mixtures	365	1,370	3.75
Road base and coverings 2/	710	3,500	4.93
Fill	2,350	5,560	2.37
Other miscellaneous uses 3/	1,020	4,810	4.72
Unspecified: 4/			
Actual	3,910	17,400	4.44
Estimated	3,840	12,400	3.22
Total or average	19,200	75,500	3.93

1/ Data are rounded to three significant digits; may not add to totals shown.
2/ Includes road and other stabilization (lime).
3/ Includes filtration.
4/ Includes reported and estimated production without a breakdown by end use.

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TABLE 6

FLORIDA: CONSTRUCTION SAND AND GRAVEL SOLD OR USED IN 1997, BY USE AND DISTRICT 1/

(Thousand metric tons and thousand dollars)

Use	District 1		District 2	
	Quantity	Value	Quantity	Value
Concrete aggregate and concrete products 2/	695	2,770	W	W
Asphaltic concrete aggregates and road base materials 3/	W	W	608	3,040
Other miscellaneous uses 4/	835	2,920	6,500	29,000
Unspecified: 5/				
Actual	W	W	W	W
Estimated	1,100	3,970	1,640	4,990
Total	2,630	9,650	8,750	37,100
	District 3		District 4	
	Quantity	Value	Quantity	Value
Concrete aggregate and concrete products 2/	1,330	5,900	(6/)	(6/)
Asphaltic concrete aggregates and road base materials 3/	1,440	4,600	(6/)	(6/)
Other miscellaneous uses 4/	2,280	8,610	--	--
Unspecified: 5/				
Actual	2,090	8,120	--	--
Estimated	1,100	3,430	--	--
Total	6,800	26,100	1,050	2,690

W Withheld to avoid disclosing company proprietary data; included with "Other miscellaneous uses."
1/ Data are rounded to three significant digits; may not add to totals shown.
2/ Includes plaster and gunite sands.
3/ Includes fill and road and other stabilization (lime).
4/ Includes filtration.
5/ Includes reported and estimated production without a breakdown by end use.
6/ Withheld to avoid disclosing company proprietary data; included in "Total."

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GEORGIA

LEGEND

- County boundary
- ★ Capital
- • City
- 1 Crushed stone/sand and gravel districts

0 50 Kilometers

MINERAL SYMBOLS
(Major producing areas)

Ba	Barite	D-Q	Dimension quartzite	Per	Perlite plant
Bx	Bauxite	Fel	Feldspar	SG	Sand and gravel
Cem	Cement plant	FePg	Iron oxide pigments	IS	Industrial sand
Clay	Clay	Ful	Fuller's earth	Steel	Iron and steel plant
CS	Crushed stone	Gyp	Gypsum plant		
Cu	Copper smelter	Ka	Kaolin	TI	Titanium plant
D-G	Dimension granite	Mica	Mica		Concentration of mineral operations
D-M	Dimension marble	Mul	Synthetic mullite		

Source: Georgia Geologic Survey/U.S. Geological Survey (1998)

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THE MINERAL INDUSTRY OF GEORGIA

This chapter has been prepared under a Memorandum of Understanding between the U.S. Geological Survey and the Georgia Geologic Survey for collecting information on all nonfuel minerals.

In 1998, the preliminary estimated value[1] of nonfuel mineral production for Georgia was $1.79 billion, according to the U.S. Geological Survey (USGS). This was a more than 6.5% increase from that of 1997,[2] following a 3.4% decrease from 1996 to 1997. Georgia's nonfuel mineral production represented more than 4.5% of the total U.S. nonfuel mineral production value, and the State remained by value the sixth largest producing State.

Georgia was by far the leading clay-producing State in the Nation, accounting for more than 26% of total U.S. clay production. Kaolin remained the State's foremost nonfuel mineral commodity in 1998, accounting for 58% of Georgia's estimated total nonfuel mineral value and, of that, about 92% of its clay value. In 1998, nearly all other nonfuel mineral commodities increased in value, led by a $59 million, or 6%, increase in the value of kaolin and a $47 million, or 11%, increase in the value of crushed stone. Crushed stone accounted for more than 26% of the State's nonfuel mineral production value (table 1). Smaller increases (largest to smallest) in the values of portland cement, fuller's earth, and construction sand and gravel also contributed to the State's increase for the year. In 1997, increases in crushed stone, portland cement, and industrial sand and gravel values were not enough to balance out decreases in kaolin, fuller's earth, and dimension marble, resulting in the State's net drop in value for the year.

Based on USGS estimates of the quantities produced in the United States during 1998, Georgia remained first[2] among the 50 States in kaolin and fuller's earth, second in barite and crude mica, third in iron oxide pigments, fourth in common clays, fifth in dimension stone, and seventh in crushed stone and masonry cement. Georgia rose to fourth from fifth in the production of feldspar.

[1]The terms "nonfuel mineral production" and related "values" encompass variations in meaning, depending on the minerals or mineral products. Production may be measured by mine shipments, mineral commodity sales, or marketable production (including consumption by producers) as is applicable to the individual mineral commodity.

All 1998 USGS mineral production data published in this chapter are preliminary estimates as of November 1999 and are expected to change. For some mineral commodities (for example, construction sand and gravel, crushed stone, and portland cement), estimates are updated periodically. To obtain the most current information, please contact the appropriate USGS mineral commodity specialist. A telephone listing for the specialists may be retrieved over the Internet at http://minerals.usgs.gov/minerals/contacts/comdir.html; by using MINES FaxBack at (703) 648-4999 from a fax machine with a touch-tone handset (request Document #1000 for a telephone listing of all mineral commodity specialists); or by calling USGS information at (703) 648-4000 for the specialist's name and number. All Mineral Industry Surveys—mineral commodity, State, and country—also may be retrieved over the Internet at http://minerals.usgs.gov/minerals; facsimile copies may be obtained from MINES FaxBack.

[2]Values, percentage calculations, and rankings for 1997 may vary from the *Minerals Yearbook, Area Reports: Domestic 1997, Volume II*, owing to the revision of preliminary 1997 to final 1997 data. Data for 1998 are preliminary and expected to change, while related rankings may also be subject to change.

The following narrative information was provided by the Georgia Geologic Survey[3] (GGS), in cooperation with representatives of Elberton Granite Association, the Georgia Mining Association, and the Georgia Crushed Stone Association (GCSA). Overall in 1998, Georgia's mining industry was strong and spent millions of dollars in research and development. Kaolin exports increased 2% over 1997 and kaolin was the leading export commodity out of the port of Savannah. However, the State's kaolin industry experienced strong competition during the year; Brazilian production notably cut into Georgia's overseas kaolin market. The French company Imetal SA, which recently acquired the bauxite operations of Mullite Corp., made an offer to buy ECC International, one of Georgia's leading kaolin producers.

The GCSA, which includes all major producers in Georgia, reported that in 1998 its quarries shipped a record total of nearly 68 million metric tons of crushed stone. In 1998, there were over 60 active quarries in Georgia, according to the GCSA. Several new quarries were brought on-line during the year, while others increased production capacity. In part, based on January 1999's alltime high record crushed stone production, continued growth of the State's crushed stone industry is expected throughout 1999. Additionally, industry representatives generally projected that increases in production should continue because of an anticipated 70% increase in funding for highway construction in the upcoming Federal Budget.

Throughout the crushed stone industry, company consolidations and increased automation at all levels of production were expected to continue in the near future. An industry-sponsored degree program in quarry management was in the planning and development stage and scheduled to start in the fall of 1999 at Southern Polytechnic State University in Marietta, GA. Atlanta metro area counties had continued air quality problems—particularly for ozone nonattainment. A State Clean Air Task Force was established to assure that Georgia will comply with the Federal Clean Air Act. Alternative transportation strategies for the Atlanta metro area could have a significant impact on future transportation-related construction.

Georgia's dimension granite industry includes operations in Elbert, Oglethorpe, Wilkes, Madison, Oconee, and Greene Counties (ranked by descending order of tons produced as reported in 1997 USGS canvass); however, most quarries and plants are in Elbert County. During 1998, there were 44 active quarries producing monumental-grade granite. The industry employed approximately 2,400 individuals with a quarry workforce of 283 production workers. In 1998, the total industry payroll was $53.9 million while the quarry payroll was $6.8 million. Although local sales of granite remained

[3]Bruce J. O'Connor, Supervisory Geologist, authored the text of mineral industry information submitted by the Georgia Geologic Survey.

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strong in 1998, sales to historically favorable Pacific Rim markets remained somewhat weak. However, demand for curbing stone for markets in the northeastern United States continued to be very strong. In September, the Georgia Marble Co., operator of a dimension marble quarry in Picken's County, announced the acquisition of Central Granite Co., Inc., one of the largest monument manufacturing firms in the Elberton area. In order to address a continuing shortage of semiskilled and skilled labor, the dimension granite industry continued the development of job training programs for entry level as well as existing employees.

An economic analysis of a possible severance tax on the State's mining industry was completed by a Georgia State University (GSU) professor and Director of GSU's Economic Forcasting Center. The study concluded that such a tax would be regressive in nature. In 1998 the Georgia Geologic Survey published a new edition of the *Mining Directory of Georgia,* listing more than 400 individual mines, pits, and quarries. This and other GGS publications and maps are available through the agency's office of maps and publications.

TABLE 1
NONFUEL RAW MINERAL PRODUCTION IN GEORGIA 1/ 2/

(Thousand metric tons and thousand dollars unless otherwise specified)

Mineral	1996 Quantity	1996 Value	1997 Quantity	1997 Value	1998 p/ Quantity	1998 p/ Value
Clays:						
Common	1,660	11,200	1,820	11,600	1,860	11,800
Fuller's earth	739	89,200	576	70,500	623	73,800
Kaolin	8,040	1,050,000	8,300	981,000	8,760	1,040,000 r/
Gemstones	NA	32	NA	8	NA	8
Sand and gravel:						
Construction	6,520	24,500	6,410	24,600	7,000	27,800
Industrial	313	5,650	520	9,330	520	9,330
Stone:						
Crushed 3/	63,400	401,000	65,300	429,000	71,000	476,000
Dimension 3/ metric tons	89,600	10,300	68,700	9,810	73,200	9,830
Combined values of barite, cement, feldspar, iron oxide pigments (crude), lime, mica (crude), stone (crushed marble, dimension marble)	XX	148,000	XX	144,000	XX	150,000
Total	XX	1,740,000	XX	1,680,000	XX	1,790,000 r/

r/ Revised. p/ Preliminary. NA Not available. XX Not applicable.
1/ Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
2/ Data are rounded to three significant digits; may not add to totals shown.
3/ Excludes certain stones; kind and value included with "Combined values" data.

TABLE 2
GEORGIA: CRUSHED STONE SOLD OR USED, BY KIND 1/

Kind	1996 Number of quarries	1996 Quantity (thousand metric tons)	1996 Value (thousands)	1996 Unit value	1997 Number of quarries	1997 Quantity (thousand metric tons)	1997 Value (thousands)	1997 Unit value
Limestone 2/	26 r/	15,900 r/	$99,400 r/	$6.27	28	15,800	$97,900	$6.21
Marble	7	W	W	W	7	W	W	W
Granite	44 r/	46,800 r/	298,000 r/	6.35	44	49,500	330,000	6.67
Dolomite	1	W	W	W	1	W	W	W
Total	XX	63,400	401,000	6.33	XX	65,300	429,000	6.56

r/ Revised. W Withheld to avoid disclosing company proprietary data; excluded from "Total.
1/ Data are rounded to three significant digits; may not add to totals shown.
2/ Includes "Limestone-dolomite" reported with no distinction between the two.

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TABLE 3
GEORGIA: CRUSHED STONE SOLD OR USED BY PRODUCERS
IN 1997, BY USE 1/ 2/

Use	Quantity (thousand metric tons)	Value (thousands)	Unit value
Coarse aggregate (+1 1/2 inch):			
Riprap and jetty stone	436	$4,450	$10.22
Filter stone	580	4,480	7.73
Other coarse aggregate 3/	62	410	6.61
Coarse aggregate, graded:			
Concrete aggregate, coarse	6,110	39,400	6.44
Bituminous aggregate, coarse	3,390	25,200	7.44
Other graded coarse aggregate 4/	1,790	10,200	5.69
Fine aggregate (-3/8 inch):			
Stone sand, concrete	2,060	13,000	6.32
Stone sand, bituminous mix or seal	3,320	19,100	5.76
Screening, undesignated	1,150	6,550	5.68
Other fine aggregate	327	1,650	5.06
Coarse and fine aggregates:			
Graded road base or subbase	4,190	23,100	5.53
Crusher run or fill or waste	14,100	81,600	5.80
Other coarse and fine aggregate 5/	4,710	34,100	7.25
Agricultural limestone	W	W	9.59
Chemical and metallurgical: Cement manufacture	W	W	5.78
Special: Other fillers or extenders	490	3,120	6.37
Unspecified: 6/			
Actual	21,400	154,000	7.22
Estimated	547	3,690	6.74
Total	65,300	429,000	6.56

W Withheld to avoid disclosing company proprietary data; included in "Total."
1/ Includes, granite, limestone, limestone-dolomite, and dolomite; excludes marble from State to avoid disclosing company proprietary data.
2/ Data are rounded to three significant digits, except unit value; may not add to totals shown.
3/ Includes macadam.
4/ Includes bituminous surface-treatment aggregate and railroad ballast.
5/ Includes unpaved road surfacing.
6/ Includes reported and estimated production without a breakdown by end use.

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TABLE 4
GEORGIA: CRUSHED STONE SOLD OR USED BY PRODUCERS IN 1997, BY USE AND DISTRICT 1/ 2/

(Thousand metric tons and thousand dollars)

Use	District 1		District 2		District 3	
	Quantity	Value	Quantity	Value	Quantity	Value
Construction aggregates:						
Coarse aggregate (+1 1/2 inch) 3/	348	2,580	W	W	W	W
Coarse aggregate, graded 4/	1,900	12,900	W	W	W	W
Fine aggregate (-3/8 inch) 5/	1,120	7,410	W	W	W	W
Coarse and fine aggregate 6/	6,180	40,100	W	W	W	W
Other construction materials	--	--	--	--	--	--
Agricultural 7/	W	W	--	--	--	--
Chemical and metallurgical 8/	W	W	--	--	--	--
Special 9/	490	3,120	--	--	--	--
Unspecified: 10/			--	--		
Actual	7,770	62,100	W	W	W	W
Estimated	547	3,690	--	--	--	--
Total	19,100	136,000	30,700	192,000	15,500	100,000

W Withheld to avoid disclosing company proprietary data; included in "Total."
1/ Excludes marble from State to avoid disclosing company proprietary data.
2/ Data are rounded to three significant digits; may not add to totals shown.
3/ Includes filter stone, macadam, and riprap and jetty stone.
4/ Includes concrete aggregate (coarse), bituminous aggregate (coarse), bituminous surface-treatment aggregate, railroad and other graded coarse aggregate.
5/ Includes stone sand (concrete), stone sand (bituminous mix or seal), screening (undesignated), and other fine aggregate.
6/ Includes graded road base or subbase, unpaved road surfacing, and crusher run (select material or fill).
7/ Includes agricultural limestone.
8/ Includes cement and lime manufacture.
9/ Includes other fillers or extenders.
10/ Includes reported and estimated production without a breakdown by end use.

TABLE 5
GEORGIA: CONSTRUCTION SAND AND GRAVEL SOLD OR USED IN 1997,
BY MAJOR USE CATEGORY 1/

Use	Quantity (thousand metric tons)	Value (thousands)	Value per ton
Concrete aggregate (including concrete sand)	4,060	$15,400	$3.80
Plaster and gunite sands	955	3,340	3.50
Concrete products (blocks, bricks, pipe, decorative, etc.)	150	674	4.49
Asphaltic concrete aggregates and other bituminous mixtures	12	27	2.25
Fill	63	103	1.63
Other miscellaneous uses 2/	220	1,450	6.58
Unspecified: 3/			
Actual	468	1,570	3.35
Estimated	475	2,030	4.28
Total or average	6,410	24,600	3.85

1/ Data are rounded to three significant digits; may not add to totals shown.
2/ Includes road base and coverings.
3/ Includes reported and estimated production without a breakdown by end use.

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TABLE 6

GEORGIA: CONSTRUCTION SAND AND GRAVEL SOLD OR USED IN 1997,
BY USE AND DISTRICT 1/

(Thousand metric tons and thousand dollars)

Use	District 1		District 2		District 3	
	Quantity	Value	Quantity	Value	Quantity	Value
Concrete aggregate and concrete products 2/	W	W	W	W	4,320	15,700
Asphaltic concrete aggregates and road base	W	W	--	--	W	W
Fill	W	W	W	W	59	98
Other miscellaneous uses	450	2,630	657	2,610	441	1,540
Unspecified: 3/						
Actual	--	--	W	W	W	W
Estimated	132	506	132	718	211	809
Total	582	3,140	789	3,320	5,030	18,200

W Withheld to avoid disclosing company proprietary data; included with "Other miscellaneous uses."
1/ Data are rounded to three significant digits; may not add to totals shown.
2/ Includes plaster and gunite sands.
3/ Includes reported and estimated production without a breakdown by end use.

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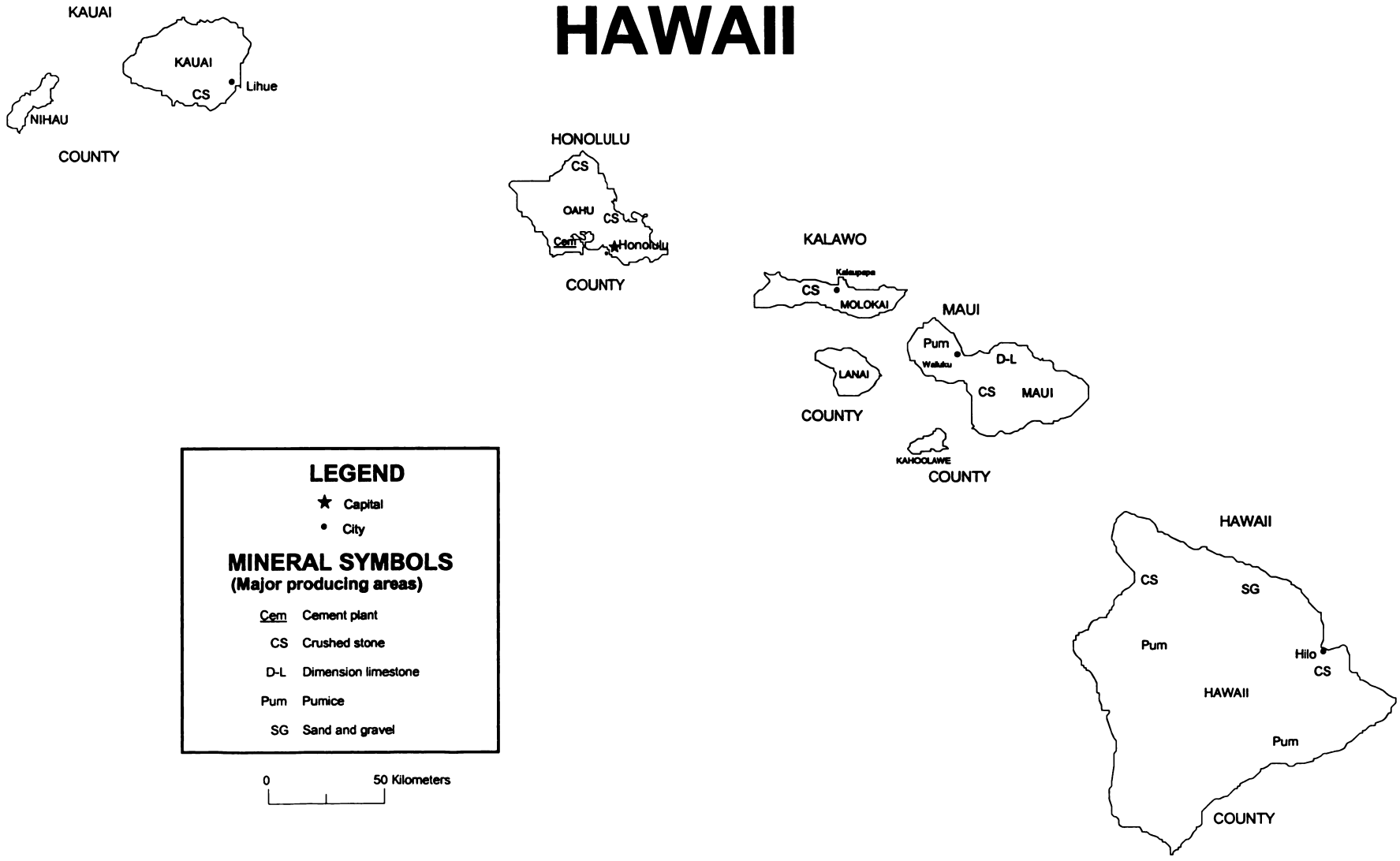
HAWAII



Source: Hawaii Division of Water and Land Development/U.S. Geological Survey (1998)

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THE MINERAL INDUSTRY OF HAWAII

In 1998, the preliminary estimated value[1] of nonfuel mineral production for Hawaii was $85.5 million, according to the U.S. Geological Survey (USGS). This was a 9% decrease from that of 1997[2] and followed a 14.8% decrease from 1996 to 1997. Mining in Hawaii consisted mostly of the quarrying of stone to produce crushed stone and the extraction of sand and gravel from open pits for use by the State's construction industry. All of the State's portland cement, albeit from imported clinker, was produced at one grinding plant on the island of Oahu, Honolulu County. Hawaii's decrease in the value of nonfuel mineral production in 1998 is mostly attributable to a 16% decrease in the value of crushed stone. Only portland cement rose in value, increasing by about $1.4 million. Both crushed stone and portland cement have shown an overall decrease in value since 1992, when they reached individual State highs. In 1992, about 9.5 million metric tons of crushed stone was produced at an estimated value of $93.5 million and 520,000 tons of portland cement was produced at a value of almost $54 million.

[1]The terms "nonfuel mineral production" and related "values" encompass variations in meaning, depending on the minerals or mineral products. Production may be measured by mine shipments, mineral commodity sales, or marketable production (including consumption by producers) as is applicable to the individual mineral commodity.

All 1998 USGS mineral production data published in this chapter are preliminary estimates as of February 1999 and are expected to change. Construction sand and gravel, crushed stone, and portland cement estimates are updated periodically. To obtain the most current information, please contact the appropriate USGS mineral commodity specialist. A telephone listing for the specialists may be retrieved over the Internet at http://minerals.usgs.gov/minerals/contacts/comdir.html; by using MINES FaxBack at (703) 648-4999 from a fax machine with a touch-tone handset (request Document #1000 for a telephone listing of all mineral commodity specialists); or by calling USGS information at (703) 648-4000 for the specialist's name and number. All Mineral Industry Surveys–mineral commodity, State, and country–also may be retrieved over the Internet at http://minerals.usgs.gov/minerals; facsimile copies may be obtained from MINES FaxBack.

[2]Values, percentage calculations, and rankings for 1997 may vary from the *Minerals Yearbook, Area Reports: Domestic 1997, Volume II*, owing to the revision of preliminary 1997 to final 1997 data. Data for 1998 are preliminary and expected to change, while related rankings may also be subject to change.

TABLE 1
NONFUEL RAW MINERAL PRODUCTION IN HAWAII 1/ 2/

(Thousand metric tons and thousand dollars unless otherwise specified)

Mineral	1996		1997		1998 p/	
	Quantity	Value	Quantity	Value	Quantity	Value
Cement:						
Masonry	5	500 e/	3	332 e/	3	300
Portland	312	32,000 e/	252	29,600 e/	261	31,000
Gemstones	NA	153	NA	66	NA	33
Sand and gravel: Construction	W	W	378	4,210	378	4,210
Stone: Crushed	6,560	77,500	5,560	59,500	5,000	50,000
Total	XX	110,000 3/	XX	93,700	XX	85,500

e/ Estimated. p/ Preliminary. NA Not available. W Withheld to avoid disclosing company proprietary data. XX Not applicable.
1/ Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
2/ Data are rounded to three significant digits; may not add to totals shown.
3/ Partial total excludes values that must be concealed to avoid disclosing company proprietary data.

TABLE 2
HAWAII: CRUSHED STONE SOLD OR USED, BY KIND 1/

Kind	1996				1997			
	Number of quarries	Quantity (thousand metric tons)	Value (thousands)	Unit value	Number of quarries	Quantity (thousand metric tons)	Value (thousands)	Unit value
Limestone	6	1,030	$10,500	$10.22	5	409	$3,090	$7.55
Granite	1	W	W	8.30	1	W	W	8.51
Traprock	17	4,220	55,100	13.06	17	3,870	44,400	11.49
Sandstone	1	W	W	10.53	1	W	W	10.78
Volcanic cinder and scoria	2	W	W	2.94	2	W	W	2.37
Miscellaneous stone	1	W	W	11.30	1	W	W	11.56
Total	XX	6,560	77,500	11.82	XX	5,560	59,500	10.71

W Withheld to avoid disclosing company proprietary data; included in "Total." XX Not applicable.
1/ Data are rounded to three significant digits, except unit value; may not add to totals shown.

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TABLE 3
HAWAII: CRUSHED STONE SOLD OR USED BY PRODUCERS
IN 1997, BY USE 1/ 2/

Use	Quantity (thousand metric tons)	Value (thousands)	Unit value
Coarse aggregate (+1 1/2 inch):			
Riprap and jetty stone	35	$416	$11.89
Other coarse aggregate 3/	63	658	10.44
Coarse aggregate, graded:			
Concrete aggregate, coarse	767	10,700	13.93
Other graded coarse aggregate 4/	281	3,960	14.09
Fine aggregate (-3/8 inch):			
Stone sand, concrete	338	5,510	16.30
Other fine aggregate 5/	179	2,410	13.45
Coarse and fine aggregates:			
Graded road base or subbase	196	2,040	10.42
Crusher run or fill or waste	760	4,860	6.39
Other coarse and fine aggregates	82	950	11.59
Other construction materials 6/	100	875	8.75
Agricultural limestone	W	W	25.00
Unspecified: Estimated 7/	W	W	9.83
Total	5,560	59,500	10.71

W Withheld to avoid disclosing company proprietary data; included in "Total."
1/ Includes granite, limestone, miscellaneous stone, sandstone, traprock, and volcanic cinder and scoria.
2/ Data are rounded to three significant digits, except unit value; may not add to totals shown.
3/ Includes filter stone.
4/ Includes bituminous aggregate (coarse), bituminous surface-treatment aggregate, and railroad ballast.
5/ Includes stone sand (bituminous mix or seal).
6/ Includes unpaved road surfacing.
7/ Includes estimated production without a breakdown by end use.

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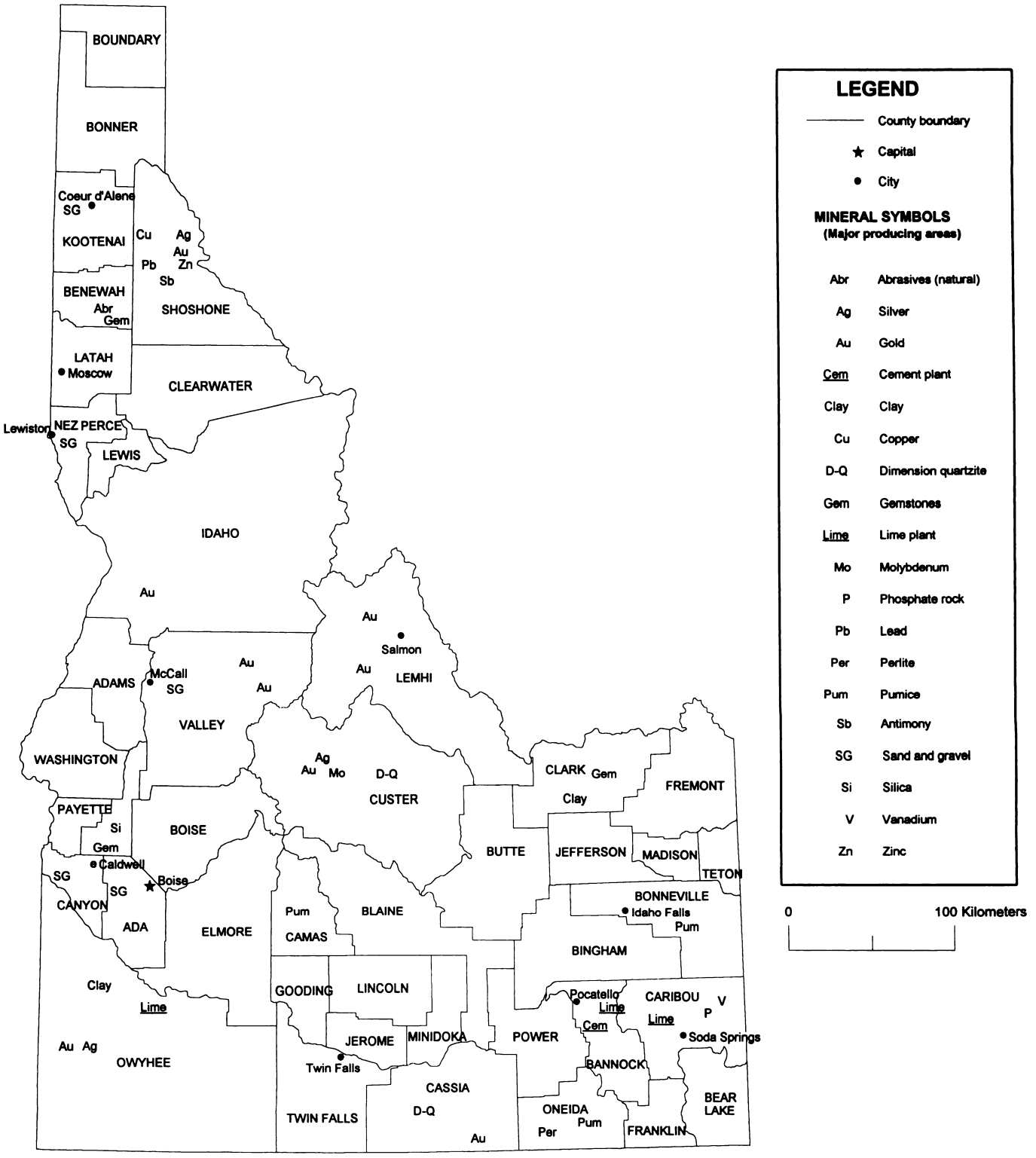
IDAHO



LEGEND

County boundary

Capital

City

MINERAL SYMBOLS
(Major producing areas)

Abr	Abrasives (natural)
Ag	Silver
Au	Gold
Cem	Cement plant
Clay	Clay
Cu	Copper
D-Q	Dimension quartzite
Gem	Gemstones
Lime	Lime plant
Mo	Molybdenum
P	Phosphate rock
Pb	Lead
Per	Perlite
Pum	Pumice
Sb	Antimony
SG	Sand and gravel
Si	Silica
V	Vanadium
Zn	Zinc

0 100 Kilometers

Source: Idaho Geological Survey/U.S. Geological Survey (1998)

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THE MINERAL INDUSTRY OF IDAHO

This chapter has been prepared under a Memorandum of Understanding between the U.S. Geological Survey and the Idaho Geological Survey for collecting information on all nonfuel minerals.

In 1998, the preliminary estimated value[1] of nonfuel mineral production for Idaho was $444 million, according to the U.S. Geological Survey (USGS). This was a 5% decrease from that of 1997,[2] following a 6% decrease from 1996 to 1997. The State remained at 31st among the 50 States in total nonfuel mineral production value, of which Idaho accounted for more than 1% of the U.S. total.

Phosphate rock, molybdenum, silver, gold, and construction sand and gravel were, by value, Idaho's leading nonfuel minerals in 1998. Continuing a trend, gold production and value declined, contributing to the total drop in value (table 1). Silver value was nearly unchanged, while the value for construction sand and gravel increased.

Based on USGS estimates of the quantities produced in the United States during 1998, Idaho remained the only State to produce antimony ore, first of three industrial garnet-producing States, third in silver and lead (descending order of value), and sixth in feldspar. While the State rose to third from fourth in the production of both molybdenum and pumice and pumicite, it dropped to third from second in phosphate rock and to eighth from seventh of 12 gold-producing States. Additionally, the State was a significant producer of construction and industrial sand and gravel.

The Idaho Geological Survey[3] (IGS) provided the narrative information that follows. Production data in the following text are those reported by the IGS, based on its own survey and estimates. They differ from some production figures reported to the USGS.

Mining and mineral exploration in Idaho was affected by the Asian recession and the global downturn in metal prices during 1998. The number of exploration projects in the State decreased. In addition, closure of the Stibnite gold mine because of exhaustion of reserves and the surprise yearend announcement that Kinross Gold Corp.'s DeLamar Mine would close were shocks to the State's precious metals industry. The silver mines, phosphate operations, and sand and gravel industry enjoyed some successes. The southeast Idaho Phosphate Reserve, with its mines and processing plants combining for an approximately one-half-billion-dollar industry, was in full production for the year. Silver production in the famous Coeur d'Alene District of north Idaho increased significantly at both Hecla Mining Co.'s Lucky Friday unit, which completed the Gold Hunter expansion project on-time and on-budget, and Sunshine Mining and Refining Co.'s Sunshine Mine. Silver prices averaged more than $5 per ounce but remained quite volatile and not up to expectations for the year.

Gold and molybdenum production showed decreases because of closures and price-induced cutbacks. The State's largest gold mine, Meridian Gold Co.'s Beartrack Mine in Lemhi County produced more than 3,421 kilograms (kg) of gold, slightly more than in 1997. Kinross Gold Corp.'s DeLamar and Stone Cabin Mines in Owyhee County poured 1,221 kg of gold and 39,871 kg of silver in 1998 from 1.16 million metric tons (Mt) of ore mined. Gold prices less than $300 per ounce prompted the premature closure at DeLamar, kept several small operations shut down, and severely cut back interest in gold exploration. The price drop also forced reevaluation of reserves and shortened the mine life for Meridian's Beartrack Mine to just another 2 years. Beartrack is a heap leach, open pit gold mine near the old placer mining ghost town of Leesburg. Meridian expanded the leach pad, focused production on the South Pit, and commenced backfilling of the North Pit. Low prices also kept the mill mothballed at CSC Mining Co.'s small, underground Rescue gold mine near Warren, although crews continued development work during the winter. A similar situation existed at U.S. Antimony Corp.'s Yellowjacket Mine in Lemhi County.

Kinross Gold Corp.'s DeLamar Mine has been a major employer and taxpayer amongst the ranchers of sparsely populated Owyhee County. Lower gold prices and reevaluation of the reserve at the nearby Stone Cabin Mine prompted the decision to put the project on a care-and-maintenance status in early 1999. Mining was to be completed at the DeLamar Mine, and final reclamation was to be started on the five open pits, which had been active since the mid-1980's. Production at the Stone Cabin Mine was stopped in November to preserve the resource remaining in the Stone Cabin and Blackjack pits. The closure cost 150 jobs.

The 1997 closure of three precious-metal mines resulted in major reclamation work in 1998. Bankruptcy proceedings not withstanding, work continued at the Black Pine Mine in Cassia County of south-central Idaho. The Pegasus Gold Corp. property went through a planned closure at the end of 1997 because of exhaustion of ore reserves. In central Idaho, Hecla Mining Co. continued recontouring and reclamation of

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[1]The terms "nonfuel mineral production" and related "values" encompass variations in meaning, depending on the minerals or mineral products. Production may be measured by mine shipments, mineral commodity sales, or marketable production (including consumption by producers) as is applicable to the individual mineral commodity.

All 1998 USGS mineral production data published in this chapter are preliminary estimates as of February 1999 and are expected to change. For some mineral commodities (for example, construction sand and gravel, crushed stone, and portland cement), estimates are updated periodically. To obtain the most current information, please contact the appropriate USGS mineral commodity specialist. A telephone listing for the specialists may be retrieved over the Internet at http://minerals.usgs.gov/minerals/contacts/comdir.html; by using MINES FaxBack at (703) 648-4999 from a fax machine with a touch-tone handset (request Document #1000 for a telephone listing of all mineral commodity specialists); or by calling USGS information at (703) 648-4000 for the specialist's name and number. All Mineral Industry Surveys—mineral commodity, State, and country—also may be retrieved over the Internet at http://minerals.usgs.gov/minerals; fascimile copies may be obtained from MINES FaxBack.

[2]Values, percentage calculations, and rankings for 1997 may vary from the *Minerals Yearbook, Area Reports: Domestic 1997, Volume II*, owing to the revision of preliminary 1997 to final 1997 data. Data for 1998 are preliminary and expected to change, while related rankings may also be subject to change.

[3]Virginia Gillerman, Research Economic Geologist, authored the text of the Idaho mineral industry information submitted by the Idaho Geological Survey.

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the waste dumps and worked to dewater the tailings pond at its Grouse Creek Mine in Custer County.

At the closed Stibnite Mine in Valley County, cleanup of the processing plants was taken over by the State in 1998 after Dakota Mining Co. forfeited its $800,000 reclamation bond on the heap-leach gold mine. In addition, Mobil Oil Corp. stepped in to finance and direct work on remediation of the historic Meadow Creek tailings area on behalf of Superior Oil Corp., which operated Stibnite from 1982-85. Woodward Clyde Corp. of Denver is the prime contractor, and Nelson Construction Co. of Boise has been doing the work.

A steady decline in molybdenum prices throughout the year affected Thompson Creek Mining Co.'s large, open pit Thompson Creek Mine in Custer County. Mining for a Phase 4 pushback started in April, but by October the price drop forced a 25% production cut and layoffs of 75 workers at the mine. A Supplemental Environmental Impact Statement on handling of the pyritic mill tails was completed in late summer, but the U.S. Forest Service decision was not scheduled until 1999. Subaqueous deposition is the preferred alternative. The company hosted the annual meeting of the International Molybdenum Association in Sun Valley in August.

Mines in the Coeur d'Alene District of north Idaho have produced more than 31,000 metric tons (t) of silver since 1884, along with appreciable base metals. Silver production in the Silver Valley increased to more than 342 t in 1998, versus 299 t in 1997. The increase resulted from past exploration success by geologists at the three currently operating deep underground mines: Sunshine Mining Co.'s Sunshine Mine, Hecla's Lucky Friday Mine, and Silver Valley Resources' Galena Mine. The Coeur Mine, another Silver Valley Resources property, was placed on standby in July, but exploration continued. Silver Valley Resources is a joint venture of ASARCO Incorporated and Coeur d'Alene Mines Corp.

Sunshine Mining and Refining Co. had mixed news from their famous Sunshine Mine, which has more than 11,000 t of historic production. Total output increased to more than 180 t of silver in 1998, up from 131 t in 1997 and the highest since 1971. Production was primarily from the galena and tetrahedrite of the West Chance vein. An aggressive exploration drilling program delineated the apparent edge of the ore body and failed to expand the reserve base by yearend. The company took a $50-million writeoff on the mine in the third quarter of 1998, though drilling continued. Another exploration project, driving a ramp over to the ConSil Mine, was terminated in October when silver prices fell below $5 per ounce.

Hecla Mining Co. successfully completed the $16 million development of the Gold Hunter ore body and expansion of the Lucky Friday Mine at Mullan. The higher grade ore contributed to a doubling of silver production from the Lucky Friday unit to 128 t in 1998 versus 59 t in 1997. Total cash costs also decreased as a result of the higher grade ore, which is mined by both overhand and underhand cut-and-fill methods using diesel equipment on an innovative ramp system.

The New Bunker Hill Mining Co. continued mining for pyromorphite crystals at the Bunker Hill Mine. It completed rebuilding the hoist on the Kellogg tunnel level and stockpiled zinc ore. The New Jersey Mining Company (Mine Systems Design) evaluated a large gold-quartz vein at the old New Jersey Mine.

Formation Capital Corporation continued work on the Sunshine project in the Idaho Cobalt Belt of Lemhi County. Through unpatented claims staked in 1994, Formation Capital owns 100% of the Sunshine project in the Blackbird Mining District, the only known domestic resource of high-grade cobalt.

Phosphate mining and processing is the largest mineral industry in Idaho. The Phosphoria Formation supplies ore to four major mines in Caribou County in southeastern Idaho. According to the IGS, production levels increased slightly to approximately 6.1 Mt of ore mined. Market demand for phosphate fertilizer and other products remained high, though prices were starting to drop because of the slump in Asian markets. As reported by the IGS, Boise-based J.R. Simplot Co.'s Smoky Canyon Mine near the Idaho-Wyoming border is the largest producer with nearly 2.3 Mt extracted. The mine increased output to accommodate a planned expansion of Simplot's phosphoric acid fertilizer plant in Pocatello. Smoky Canyon ore is sent to the plant through a 140-km-long slurry line. Simplot also did exploration drilling on its Deer Creek lease and won a State reclamation award for past exploration projects.

Agrium Inc., a Canadian agribusiness, operates a fertilizer plant at Conda, just north of Soda Springs. The plant employs 285 people and had another record year. In January, Agrium finalized acquisition of Rhone-Poulenc's Rasmussen Ridge Mine. In March, Agrium hired MK Mining as contract miners. Main production is from the Central Pit. Stripping and production also began from the North Pit with all of the ore going to the plant at Conda.

Solutia Inc., formerly part of Monsanto, operates the Enoch Valley Mine and an elemental phosphorus plant at Soda Springs. Their plant also had a record year. A $2 million safety project was started to relocate the ore unloading station to the east side of the highway and install a 600-km-long conveyor belt in a culvert under the road. This will eliminate the need for large ore trucks to cross the highway next to the plant. Slag from the phosphorus plant is used by Kerr-McGee's vanadium plant across the road to produce vanadium pentaoxide, used by the steel industry. In June, the company started up a single phosphate fertilizer plant to help use up the vanadium tailings, which contain about 14% phosphate. Vanadium is naturally enriched in the Phosphoria Formation, as is selenium. Work by the industry-lead Selenium Working Group's third party contractor, Montgomery Watson, included extensive sampling for metals in soil, water, and vegetation in the region. Research is ongoing to find ways to reduce the hazard.

FMC Corp. was mining from the B Pit at the Dry Valley Mine and permitting the C and D pits. The company won Idaho Land Board reclamation awards for both its quartzite quarry and the Dry Valley mine A Pit reclamation work. FMC operates the world's largest elemental phosphorus plant at Pocatello. The company reached a consent agreement with the Environmental Protection Agency in October for a $190 million program to reduce air and other pollution at the plant. Projects include pond remediation, waste treatment, air quality improvements and health studies for the Shoshone-Bannock

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tribe, as the plant is on the Fort Hall Reservation. FMC also plans to rebuild one of the four electric furnaces.

Strong demand for construction sand and gravel continued, particularly in urban areas. Idaho and other Western States are experiencing rising population growth and development. There has been a steady demand for and production of dimension stone and landscaping rock. Hecla's Mountain West Bark merged with Colorado Aggregate Inc. to form MWCA, based in Rexburg. MWCA produces red and gold pumice for landscaping. Sales of the unusual gold-colored pumice were up tremendously.

However, some industrial mineral commodities were affected by the economic slowdown overseas. In north Idaho, Emerald Creek Garnet saw sales of its industrial garnets, used for abrasives and water jets, slow slightly. The company has plans to expand operations to a 160-hectare parcel near the St. Maries River, adjacent to current leases. The project will require an Environmental Impact Statement and a 404 permit. Hess Pumice Products in southeastern Idaho sells fine, ultrapure pumice for polishing television screens. Sales to the Pacific Rim countries were down. Hess is collaborating on a new product, a special microgrout cement, which is more stable chemically and can penetrate finer cracks. Also in southeastern Idaho at Inkom, Ash Grove Cement Co. had another record year, shipping 245,000 t of clinker. Ash Grove is Idaho's only cement operation.

TABLE 1
NONFUEL RAW MINERAL PRODUCTION IN IDAHO 1/ 2/

(Thousand metric tons and thousand dollars unless otherwise specified)

Mineral		1996 Quantity	1996 Value	1997 Quantity	1997 Value	1998 p/ Quantity	1998 p/ Value
Antimony	metric tons	242	W	356	W	W	W
Gemstones		NA	347	NA	687	NA	614
Gold 3/	kilograms	10,800	136,000	7,490	80,100	4,990	47,500
Pumice and pumicite	metric tons	159,000	1,340	83,100	758	114,000	1,010
Sand and gravel:							
Construction		14,700	46,100	14,800	42,700	15,500	46,000
Industrial		646	8,510	630	7,950	698	8,930
Silver 3/	metric tons	234	39,000	341	53,800	335	54,900
Stone: Crushed 4/		3,960	20,200	3,910	18,700	3,000	13,500
Combined values of cement, copper, feldspar, garnet (industrial), lead, lime, molybdenum, phosphate rock, stone [crushed quartzite (1997-98), crushed miscellaneous (1996), dimension quartzite and miscellaneous], vanadium, zinc, and values indicated by symbol W		XX	249,000	XX	264,000	XX	272,000
Total		XX	500,000	XX	469,000	XX	444,000

p/ Preliminary. NA Not available. W Withheld to avoid disclosing company proprietary data; value included with "Combined values" data. XX Not applicable.

1/ Production as measured by mine shipments, sales, or marketable production (including consumption by producers).

2/ Data are rounded to three significant digits; may not add to totals shown.

3/ Recoverable content of ores, etc.

4/ Excludes certain stones; value included with "Combined values" data.

TABLE 2
IDAHO: CRUSHED STONE SOLD OR USED, BY KIND 1/

Kind	1996 Number of quarries	1996 Quantity (thousand metric tons)	1996 Value (thousands)	1996 Unit value	1997 Number of quarries	1997 Quantity (thousand metric tons)	1997 Value (thousands)	1997 Unit value
Limestone	7	1,370	$7,920	$5.80	7	1,150	$5,860	$5.09
Granite	7	549	3,060	5.57	3	140	243	1.74
Traprock	27	1,680	6,150	3.66	22	1,460	6,420	4.39
Quartzite	10	371	3,110	8.40	4	(2/)	(2/)	(2/)
Miscellaneous stone	3	(2/)	(2/)	(2/)	4	1,160	6,190	5.35
Total	XX	3,960	20,200	5.11	XX	3,910	18,700	4.78

XX Not applicable.

1/ Data are rounded to three significant digits; may not add to totals shown.

2/ Excludes miscellaneous stone and quartzite from State total to avoid disclosing company proprietary data.

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TABLE 3
IDAHO: CRUSHED STONE SOLD OR USED BY PRODUCERS
IN 1997, BY USE 1/ 2/

Use	Quantity (thousand metric tons)	Value (thousands)	Unit value
Coarse aggregate (+1 1/2 inch): Riprap and jetty stone	38	$56	$1.47
Coarse aggregate, graded:			
Bituminous surface-treatment aggregate	4	16	4.00
Other graded coarse aggregate 3/	231	478	2.07
Fine aggregate (-3/8 inch); Screening (undesignated)	14	45	3.21
Coarse and fine aggregates:			
Graded road base or subbase	467	1,910	4.09
Unpaved road surfacing	86	451	5.24
Other construction materials 4/	30	158	5.27
Agricultural:			
Poultry grit and mineral food	W	W	3.29
Other agricultural uses	W	W	3.36
Chemical and metallurgical:			
Cement manufacture	W	W	2.76
Lime manufacture	W	W	5.97
Flux stone	(5/)	(5/)	3.33
Sulfur oxide removal	W	W	2.00
Special:			
Mine dusting or acid water treatment	(5/)	(5/)	3.31
Other fillers or extenders	20	287	14.35
Unspecified: 6/			
Actual	1,890	9,740	5.15
Estimated	10	58	5.80
Total	3,910	18,700	4.78

W Withheld to avoid disclosing company proprietary data; included in "Total."
1/ Includes granite, limestone, miscellaneous stone, and traprock; excludes quartzite from State total to avoid disclosing company proprietary data.
2/ Data are rounded to three significant digits, except unit value; may not add to totals shown.
3/ Includes concrete aggregate (coarse), bituminous aggregate (coarse), and railroad ballast.
4/ Includes crusher run or fill or waste.
5/ Less than 1/2 unit.
6/ Includes reported and estimated production without a breakdown by end use.

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TABLE 4
IDAHO: CRUSHED STONE SOLD OR USED BY PRODUCERS IN 1997,
BY USE AND DISTRICT 1/ 2/

(Thousand metric tons and thousand dollars)

Use	District 1		Unspecified districts	
	Quantity	Value	Quantity	Value
Construction aggregates:				
Coarse aggregate (+1 1/2 inch) 3/	38	56	--	--
Coarse aggregate, graded 4/	W	W	--	--
Fine aggregate (-3/8 inch) 5/	14	45	--	--
Coarse and fine aggregate 6/	770	3,310	--	--
Other construction materials	253	597	--	--
Agricultural 7/	(8/)	(8/)	--	--
Chemical and metallurgical 9/	1,080	5,360	--	--
Special 10/	(8/)	(8/)	--	--
Unspecified: 11/				
Actual	(8/)	(8/)	1,120	5,890
Estimated	(8/)	(8/)	--	--
Total	2,790	12,800	1,120	5,890

W Withheld to avoid disclosing company proprietary data; included with "Other construction materials."
1/ Excludes quartzite from State total to avoid disclosing company proprietary data.
2/ Data are rounded to three significant digits; may not add to totals shown.
3/ Includes, riprap and jetty stone.
4/ Includes concrete aggregate (coarse), bituminous aggregate (coarse), bituminous surface-treatment aggregate, railroad ballast, and other graded coarse aggregate.
5/ Includes screening (undesignated).
6/ Includes graded road base or subbase, unpaved road surfacing, crusher run (select material or fill), and other coarse and fine aggregate.
7/ Includes poultry grit and mineral food, and other agricultural uses.
8/ Withheld to avoid disclosing company proprietary data; included in "Total."
9/ Includes cement and lime manufacture, flux stone, and sulfur oxide removal.
10/ Includes mine dusting or acid water treatment and other fillers or extenders.
11/ Includes reported and estimated production without a breakdown by end use.

TABLE 5
IDAHO: CONSTRUCTION SAND AND GRAVEL SOLD OR USED IN 1997,
BY MAJOR USE CATEGORY 1/ 2/

Use	Quantity (thousand metric tons)	Value (thousands)	Value per ton
Concrete aggregate (including concrete sand)	2,660	$8,840	$3.32
Plaster and gunite sands	13	72	5.54
Concrete products (blocks, bricks, pipe, decorative, etc.)	32	262	8.19
Asphaltic concrete aggregates and other bituminous mixtures	1,400	4,220	3.02
Road base and coverings 3/	6,140	17,800	2.90
Fill	572	1,140	1.99
Snow and ice control	90	528	5.87
Railroad ballast	53	165	3.11
Other miscellaneous uses 4/	182	709	3.90
Unspecified: 5/			
Actual	2,980	6,970	2.34
Estimated	696	1,980	2.85
Total or average	14,800	42,700	2.88

1/ To avoid disclosing company proprietary data, no district tables were produced for 1997.
2/ Data are rounded to three significant digits; may not add to totals shown.
3/ Includes road and other stabilization (cement).
4/ Includes filtration.
5/ Includes reported and estimated production without a breakdown by end use.

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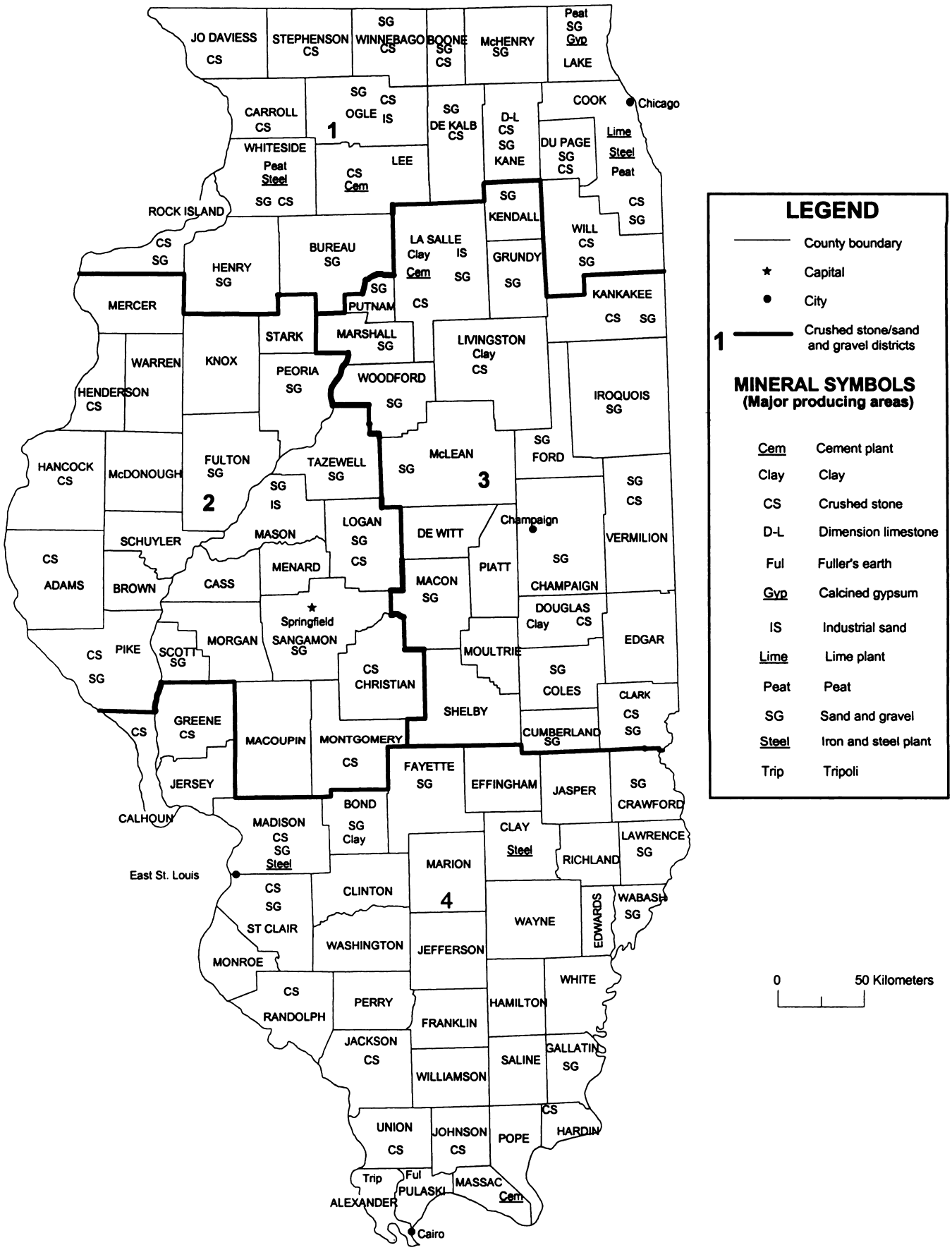
ILLINOIS



Source: Illinois State Geological Survey/U.S. Geological Survey (1998)

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THE MINERAL INDUSTRY OF ILLINOIS

This chapter has been prepared under a Memorandum of Understanding between the U.S. Geological Survey and the Illinois State Geological Survey for collecting information on all nonfuel minerals.

In 1998, the preliminary estimated value[1] of nonfuel mineral production for Illinois was $862 million, according to the U.S. Geological Survey (USGS). This was about a 4% increase from that of 1997,[2] and followed a 2% decrease from 1996 to 1997. The State rose to 17th from 18th in rank among the 50 States in total nonfuel mineral production value, of which Illinois accounted for more than 2% of the U.S. total.

All of Illinois' total nonfuel mineral production value in 1998 resulted from the production of industrial minerals; no metals have been produced from mines in the State since 1996 when small quantities of copper, lead, silver, and zinc were produced. Crushed stone, by value, was the State's leading commodity, accounting for about 44% of the total, followed by portland cement with 23%, and construction sand and gravel with about 17%. In 1998, nearly all mineral commodities increased in value, led by crushed stone up $19 million, portland cement up $12 million, fuller's earth and tripoli, up a combined $13 million, and construction and industrial sand and gravel, up a combined $10 million (table 1). Gemstones and peat values were unchanged. In 1997, decreases in the values of crushed stone, fuller's earth, and lime accounted for most of the State's drop in value. Only portland cement and industrial sand and gravel showed increases in value for the year (table 1).

Compared with USGS estimates of the quantities of minerals produced in the other 49 States in 1998, Illinois remained first[2] in industrial sand and gravel and tripoli, eighth in crushed stone, and ninth in construction sand and gravel and portland cement. The State rose to third from fourth in peat, dropped to fifth from fourth in fuller's earth, and remained a significant lime-producing State. Raw steel was produced in the State, but it was processed from materials obtained from other domestic and foreign sources. Illinois remained fourth in the Nation in the manufacture of raw steel with an estimated output of 6.7 million metric tons (7.4 million short tons), according to the American Iron and Steel Institute.

The following narrative information was provided by the Illinois State Geological Survey.[3] Industrial mineral production in Illinois overall continued to increase in 1998, as did the tendency of crushed stone production to increase faster than that of construction sand and gravel. Production of portland cement, common clay, industrial sand (quartz), lime, and tripoli also increased, while fuller's earth and peat showed decreases.

Vulcan Materials Co. successfully expanded in a new venture of using unit trains (trains carrying only one company's products) to transport crushed stone products from quarries to rail yard distribution centers in the appropriate market areas. The company established a distribution center at a rail yard in Champaign County; unit trains from Kankakee County supply it with crushed stone for the busy construction industry in east-central Illinois. Unit train product transport is proving to be economical and reduces the road hauling of aggregates, which is one of the main objections to the mining of stone and sand and gravel in the State.

The unit train idea is not new, it was a common way to transport aggregates before heavy-duty highways and high-capacity trucks were developed. Many companies in bordering States have been shipping aggregates by truck and train into Illinois for years, although transportation of aggregates by water into Illinois is much less common. Exceptions include crushed stone shipped in by barge from Vulcan's huge Reed Quarry in western Kentucky, and crushed stone shipped by lake freighter to Chicago, IL, from Michigan Limestone's Rogers City Quarry, located in Michigan on the coast of Lake Huron.

Vulcan Materials also expanded its market area in far southern Illinois with the purchase of two crushed stone (limestone) quarries from Columbia Quarry Co. They are the Jonesboro Quarry in Union Co. and the Cypress Quarry in Johnson Co. In central Illinois' Macon County, Vulcan closed one sand and gravel operation and reopened a recently acquired site, resulting in the replacment of lost production without the expense of opening a new extraction site.

In McLean County (central Illinois), Stark Materials Inc. was able to open a large sand and gravel pit southwest of Bloomington after favorable votes from the County Zoning Board of Appeals and the County Board. Twenty-two hearings over a period of 1 year were necessary for the company and county to resolve many issues concerning the 310-hectare site. The main issues were preservation of farm land, road safety, and groundwater contamination. A major consideration was the area's significant need for aggregates and the fact that one large pit consumes less farm land than

[1]The terms "nonfuel mineral production" and related "values" encompass variations in meaning, depending on the minerals or mineral products. Production may be measured by mine shipments, mineral commodity sales, or marketable production (including consumption by producers) as is applicable to the individual mineral commodity.

All 1998 USGS mineral production data published in this chapter are preliminary estimates as of February 1999 and are expected to change. For some mineral commodities (for example, construction sand and gravel, crushed stone, and portland cement), estimates are updated periodically. To obtain the most current information, please contact the appropriate USGS mineral commodity specialist. A telephone listing for the specialists may be retrieved over the Internet at http://minerals.usgs.gov/minerals/contacts/comdir.html; by using MINES FaxBack at (703) 648-4999 from a fax machine with a touch-tone handset (request Document #1000 for a telephone listing of all mineral commodity specialists); or by calling USGS information at (703) 648-4000 for the specialist's name and number. All Mineral Industry Surveys—mineral commodity, State, and country—also may be retrieved over the Internet at http://minerals.usgs.gov/minerals; facsimile copies may be obtained from MINES FaxBack.

[2]Values, percentage calculations, and rankings for 1997 may vary from the *Minerals Yearbook, Area Reports: Domestic 1997, Volume II*, owing to the revision of preliminary 1997 to final 1997 data. Data for 1998 are preliminary and expected to change, while related rankings may also be subject to change.

[3]John M. Masters, Geologist, authored the text of State minerals industry information provided by the Illinois State Geological Survey.

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many small ones. Stark Material's pit will be a dredge operation that will not discharge water off site. The company will have groundwater monitoring wells installed and have water samples collected and tested quarterly and will upgrade and maintain county access roads. The pit is expected to supply aggregates for more than 20 years to the local construction industry at competitive prices.

Southernmost Illinois' absorbent clay mining industry was cut back when Golden Cat Corp. closed its mine, processing, packaging, and storage facilities in Olmsted, Pulaski County. From the 1920's into the 40's, the highly absorbent Paleocene-age Porters Creek clay was mined near Olmsted by Standard Oil Co. of Indiana and Sinclair Oil Corp. principally to remove contaminants and clarify oil products. Other uses included that of a sweeping compound to soak-up oil and water from service-station garage floors. Lowe's Southern Clay, Inc. acquired the old Olmsted clay properties and resumed mining in 1958, at which time the company founder developed the idea of using the absorbent clay instead of sand in cat litter boxes. The product was marketed under commonly heard trade names like "Kitty Litter" and "Tidy Cat." After the operation was sold twice in the 1990's, the current owner, Ralston Purina Co. of St. Louis, MO, decided to close because they could meet their market demand more efficiently with the company's operations elsewhere.

Oil-Dri Corporation of America purchased the only remaining absorbent clay company in the State from American Colloid Corp. Oil-Dry operates the mine, which is also near Olmsted, but trucks the clay about 13 kilometers to processing and shipping facilities in Mounds City.

Exploration

Limited mineral test drilling was recorded with the Illinois Office of Mines and Minerals in 1998. Exploration continued for additional absorbent clay resources in the portion of Pulaski County generally underlain by the Porters Creek clay. In northeastern Illinois, some exploration drilling was conducted for dolomite resources. When possible, aggregate producers have been expanding reserves by acquiring land adjacent to existing operations or buying smaller operations rather than exploring for new mine sites.

Government Actions

The Illinois Department of Transportation's plan to expand the current Aggregate Gradation Control System likely will affect most aggregate producers. Aggregate producers are responsible for gradation-control testing of coarse and fine aggregate products and manufactured sand used in portland-cement concrete and in higher quality hot-mix asphalt layers. The planned expansion will require producers to also test gradations of all aggregate products used in all other asphaltic and portland-cement mixtures, chip seals, and other size-graded aggregates used in their unbound state. Full implementation of the expanded system was scheduled for July 1, 2001.

Reclamation

A booming construction industry in northeastern Illinois has created a high demand for imaginative uses of past and present aggregate extraction sites. Lake County Grading, Inc., which recently closed its sand and gravel pit north of Libertyville, was a good example of community-conscious reclamation work. The company helped the Lake County Forest Preserve convert the site into a multi-use park with a state-of-the-art recreation center. Another example of current reclamation efforts is that of the transformation of a long-closed sand and gravel pit, north of Plainfield in Will County. At that location, a beautiful lake will soon be surrounded by an assortment of large homes and town houses. One highlight of this development is a traditional-style covered bridge, built to current bridge construction codes.

TABLE 1
NONFUEL RAW MINERAL PRODUCTION IN ILLINOIS 1/ 2/

(Thousand metric tons and thousand dollars unless otherwise specified)

Mineral	1996 Quantity	1996 Value	1997 Quantity	1997 Value	1998 p/ Quantity	1998 p/ Value
Cement: Portland	2,620	181,000 e/	2,590	186,000 e/	2,690	198,000
Clays:						
Common	155 r/	736	100	533	102	544
Fuller's earth	330	W	W	W	W	W
Fluorspar metric tons	8,180	W	--	--	--	--
Gemstones	NA	890	NA	8	NA	8
Sand and gravel:						
Construction	34,600	144,000	33,400	143,000	33,800	149,000
Industrial	4,460	66,400	4,610	67,900	4,870	71,500
Stone: Crushed	66,500	364,000	65,700	357,000	68,300	376,000
Combined values of copper (1996), lead (1996), lime, peat, silver (1996), tripoli (1996-97), zinc (1996), and values indicated by symbol W	XX	89,100	XX	73,600	XX	67,100
Total	XX	846,000	XX	829,000	XX	862,000

e/ Estimated. p/ Preliminary. r/ Revised. NA Not available. W Withheld to avoid disclosing company proprietary data; value included with values" data. XX Not applicable.

1/ Production as measured by mine shipments, sales, or marketable production (including consumption by producers).

2/ Data are rounded to three significant digits; may not add to totals shown.

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TABLE 2

ILLINOIS: CRUSHED STONE SOLD OR USED, BY KIND 1/

Kind	1996 Number of quarries	1996 Quantity (thousand metric tons)	1996 Value (thousands)	1996 Unit value	1997 Number of quarries	1997 Quantity (thousand metric tons)	1997 Value (thousands)	1997 Unit value
Limestone 2/	127	57,700	$319,000	$5.52	125	56,900	$312,000	$5.48
Dolomite	19	8,800	45,000	5.11	23	8,850	45,500	5.14
Total	XX	66,500	364,000	5.47	XX	65,700	357,000	5.44

XX Not applicable.

1/ Data are rounded to three significant digits; may not add to totals shown.

2/ Includes limestone-dolomite reported with no distinction between the two.

TABLE 3

ILLINOIS: CRUSHED STONE SOLD OR USED BY PRODUCERS IN 1997, BY USE 1/ 2/

Use	Quantity (thousand metric tons)	Value (thousands)	Unit value
Coarse aggregate (+1 1/2 inch):			
Macadam	841	$4,960	$5.90
Riprap and jetty stone	342	2,840	8.30
Filter stone	95	428	4.51
Other coarse aggregate	344	1,820	5.30
Coarse aggregate, graded:			
Concrete aggregate, coarse	5,830	32,900	5.65
Bituminous aggregate, coarse	4,850	31,300	6.46
Bituminous surface-treatment aggregate	1,100	6,730	6.15
Railroad ballast	581	3,290	5.66
Other graded coarse aggregate	723	3,930	5.44
Fine aggregate (-3/8 inch):			
Stone sand, bituminous mix or seal	254	1,150	4.54
Screening, undesignated	982	3,410	3.47
Other fine aggregate 3/	600	2,520	4.20
Coarse and fine aggregates:			
Graded road base or subbase	9,040	42,600	4.71
Unpaved road surfacing	2,600	12,400	4.77
Crusher run or fill or waste	312	1,510	4.85
Other coarse and fine aggregates	1,680	8,170	4.86
Other construction materials	68	349	5.13
Agricultural:			
Agricultural limestone	2,200	8,980	4.08
Poultry grit and mineral food	40	528	13.20
Other agricultural uses	10	35	3.50
Chemical and metallurgical:			
Cement manufacture	2,470	10,400	4.20
Flux stone	W	W	5.26
Sulfur oxide removal	W	W	8.90
Special:			
Mine dusting or acid water treatment	16	180	11.25
Asphalt fillers or extenders	36	362	10.06
Whiting or whiting substitute	1	24	24.00
Other fillers or extenders	W	W	5.76
Unspecified: 4/			
Actual	21,900	124,000	5.66
Estimated	8,380	49,900	5.95
Total	65,700	357,000	5.44

W Withheld to avoid disclosing company proprietary data; included in "Total."

1/ Includes dolomite, limestone, and limestone-dolomite.

2/ Data are rounded to three significant digits, except unit value; may not add to totals shown.

3/ Includes stone sand (concrete).

4/ Includes reported and estimated production without a breakdown by end use.

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TABLE 4
ILLINOIS: CRUSHED STONE SOLD OR USED BY PRODUCERS IN 1997, BY USE AND DISTRICT 1/

(Thousand metric tons and thousand dollars)

Use	District 1		District 2		District 3		District 4	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
Construction aggregates:								
Coarse aggregate (+1 1/2 inch) 2/	W	W	103	813	160	1,090	461	2,530
Coarse aggregate, graded 3/	W	W	159	946	W	W	2,730	14,300
Fine aggregate (-3/8 inch) 4/	W	W	(5/)	(5/)	W	W	146	702
Coarse and fine aggregate 6/	7,330	35,000	523	2,820	2,500	11,600	3,270	15,200
Other construction materials	9,490	56,700	--	--	3,330	18,500	--	--
Agricultural 7/	526	1,730	220	1,040	692	3,790	(5/)	(5/)
Chemical and metallurgical 8/	(5/)	(5/)	--	--	(5/)	(5/)	(5/)	(5/)
Special 9/	--	--	(5/)	(5/)	(5/)	(5/)	--	--
Unspecified: 10/								
Actual	(5/)	(5/)	(5/)	(5/)	(5/)	(5/)	(5/)	(5/)
Estimated	3,450	18,600	1,970	14,600	1,680	9,670	1,280	7,080
Total	33,100	179,00	6,280	41,900	12,500	68,600	13,900	68,200

W Withheld to avoid disclosing company proprietary data; included with "Other construction materials."
1/ Data are rounded to three significant digits; may not add to totals shown.
2/ Includes filter stone, macadam, riprap and jetty stone, and other coarse aggregate.
3/ Includes concrete aggregate (coarse), bituminous aggregate (coarse), bituminous surface-treatment aggregate, railroad ballast, and other coarse aggregate.
4/ Includes stone sand (concrete), stone sand (bituminous mix or seal), screening (undesignated), and other fine aggregate.
5/ Withheld to avoid disclosing company proprietary data; included in "Total."
6/ Includes graded road base or subbase, unpaved road surfacing, crusher run (select material or fill), and other coarse and fine aggregates.
7/ Includes agricultural limestone, poultry grit and mineral food, and other agricultural uses.
8/ Includes cement manufacture, chemical stone, and sulfur oxide removal.
9/ Includes asphalt fillers or extenders, mine dusting or acid water treatment, and other fillers or extenders.
10/ Includes reported and estimated production without a breakdown by end use.

TABLE 5
ILLINOIS: CONSTRUCTION SAND AND GRAVEL SOLD OR USED IN 1997,
BY MAJOR USE CATEGORY 1/

Use	Quantity (thousand metric tons)	Value (thousands)	Value per ton
Concrete aggregate (including concrete sand)	5,680	$22,800	$4.02
Plaster and gunite sands	382	1,650	4.32
Concrete products (blocks, bricks, pipe, decorative, etc.)	720	3,060	4.25
Asphaltic concrete aggregates and other bituminous mixtures	1,320	5,400	4.08
Road base and coverings 2/	3,590	18,200	5.08
Fill	2,350	7,940	3.38
Snow and ice control	72	350	4.86
Other miscellaneous uses 3/	39	212	5.44
Unspecified: 4/			
Actual	10,800	44,700	4.14
Estimated	8,410	38,500	4.58
Total or average	33,400	143,000	4.28

1/ Data are rounded to three significant digits; may not add to totals shown.
2/ Includes road and other stabilization (cement).
3/ Includes filtration, railroad ballast, and roofing granules.
4/ Includes reported and estimated production without a breakdown by end use.

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TABLE 6
ILLINOIS: CONSTRUCTION SAND AND GRAVEL SOLD OR USED IN 1997,
BY USE AND DISTRICT 1/

(Thousand metric tons and thousand dollars)

Use	District 1		District 2		District 3		District 4	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
Concrete aggregate and concrete products 2/	3,090	12,500	958	4,550	1,670	6,840	1,060	3,670
Asphaltic concrete aggregates and road base materials 3/	2,580	12,300	405	1,970	1,320	6,880	611	2,460
Fill	1,220	4,230	459	1,290	W	W	W	W
Snow and ice control	52	240	W	1	19	108	(4/)	(4/)
Other miscellaneous uses 5/	11	44	11	80	15	88	--	--
Unspecified: 6/								
Actual	9,270	39,500	677	3,110	W	W	W	W
Estimated	5,320	28,200	223	630	1,740	5,730	1,130	3,960
Total	21,500	97,000	2,730	11,600	6,040	23,300	3,050	10,900

W Withheld to avoid disclosing company proprietary data; included in "Total."
1/ Data are rounded to three significant digits; may not add to totals shown.
2/ Includes plaster and gunite sands.
3/ Includes road and other stabilization (cement).
4/ Less than 1/2 unit.
5/ Includes filtration and railroad ballast.
6/ Includes reported and estimated production without a breakdown by end use.

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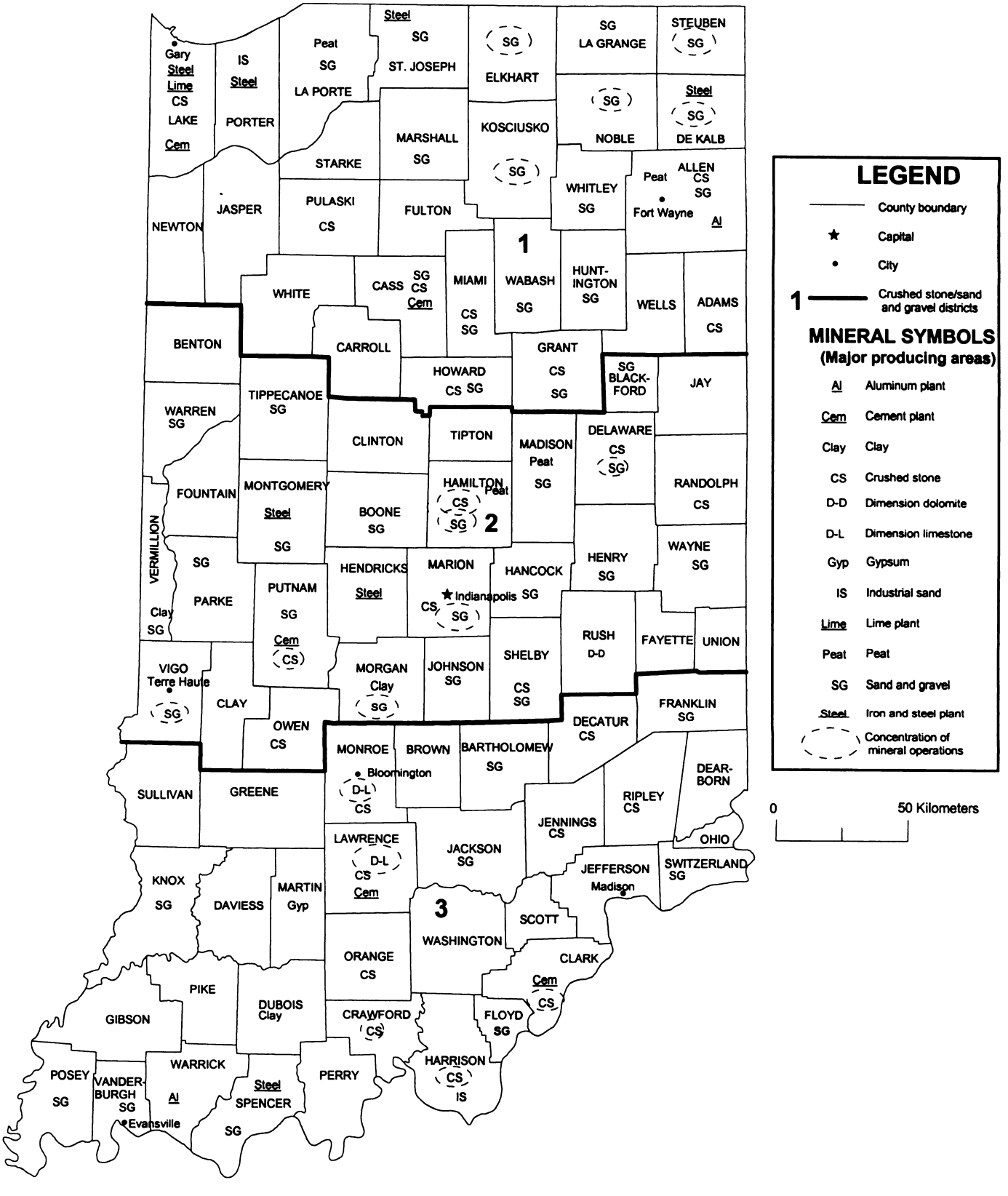
INDIANA



Source: Indiana Geological Survey/U.S. Geological Survey (1998)

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THE MINERAL INDUSTRY OF INDIANA

This chapter has been prepared under a Memorandum of Understanding between the U.S. Geological Survey and the Indiana Geological Survey for collecting information on all nonfuel minerals.

In 1998, the preliminary estimated value[1] of nonfuel mineral production for Indiana was $700 million, according to the U.S. Geological Survey (USGS). This was a more than 4% increase from that of 1997,[2] and followed a 6.7% increase from 1996 to 1997. The State remained 21st in rank among the 50 States in nonfuel mineral production value, of which Indiana accounted for close to 2% of the U.S. total.

Indiana's increase in nonfuel mineral value in 1998 mostly resulted from $10 million increases in both construction sand and gravel and portland cement, a $9 million rise in the value of crushed stone, and increases of $5 million and about $2 million respectively in dimension stone and masonry cement. In 1997, nearly all nonfuel minerals increased in value, led by a $26 million increase in crushed stone and a $15 million increase in portland cement. Only construction sand and gravel, down $7 million, and common clay, down about $1.5 million, showed any decrease.

Compared with USGS estimates of the quantities of minerals produced in the other 49 States during 1998, Indiana remained first[2] in dimension stone and masonry cement, seventh in crude gypsum, eighth in lime, and ninth in common clay. Additionally, the State was a significant producer of crushed stone, portland cement, and construction sand and gravel, ranking 12th, 12th, and 14th, respectively. The State's mines exclusively produce industrial minerals and coal; all raw steel and primary aluminum produced in the State were processed from materials received from other domestic and foreign sources. Indiana continued to lead the Nation in the production of raw steel, with an estimated output of about 21.8 million metric tons of raw steel, as reported by the American Iron and Steel Institute. Based on USGS data, the State remained third in the production of primary aluminum.

[1]The terms "nonfuel mineral production" and related "values" encompass variations in meaning, depending on the minerals or mineral products. Production may be measured by mine shipments, mineral commodity sales, or marketable production (including consumption by producers) as is applicable to the individual mineral commodity.

All 1998 USGS mineral production data published in this chapter are preliminary estimates as of February 1999 and are expected to change. For some mineral commodities (for example, construction sand and gravel, crushed stone, and portland cement), estimates are updated periodically. To obtain the most current information, please contact the appropriate USGS mineral commodity specialist. A telephone listing for the specialists may be retrieved over the Internet at http://minerals.usgs.gov/minerals/contacts/comdir.html; by using MINES FaxBack at (703) 648-4999 from a fax machine with a touch-tone handset (request Document #1000 for a telephone listing of all mineral commodity specialists); or by calling USGS information at (703) 648-4000 for the specialist's name and number. All Mineral Industry Surveys—mineral commodity, State, and country—also may be retrieved over the Internet at http://minerals.usgs.gov/minerals; fascimile copies may be obtained from MINES FaxBack.

[2]Values, percentage calculations, and rankings for 1997 may vary from the *Minerals Yearbook, Area Reports: Domestic 1997, Volume II*, owing to the revision of preliminary 1997 to final 1997 data. Data for 1998 are preliminary and expected to change, while related rankings may also be subject to change.

The following narrative information was provided by the Indiana Geological Survey[3] (IGS). Employment in the Indiana minerals industry remained strong with preliminary U.S. Mine Safety and Health Administration (MSHA) figures indicating that 3,744 persons were employed during 1998, a 3.2% increase over that of 1997.

Industrial Minerals

Many companies began new aggregate operations during the year. In Harrison County, Mulzer Crushed Stone, Inc. opened its new quarry on the Ohio River between New Amsterdam and Mauckport. The company began crushing at the site with a portable unit pending completion of the plant which is scheduled for June 1, 1999. Also along the Ohio River, approximately 101 hectares of sand and gravel will be developed near Bethlehem, Clark County. The new company, Bethlehem Sand and Gravel will barge the material to Louisville, KY. Martin Marietta Aggregates opened its new Kokomo Sand plant in Howard County. Liter's Quarry of Indiana, Inc. began a joint venture with Tom Miller Quarries, Inc. at an underground crushed stone mine in Scott County. Krafft Gravel, Inc. began development of a plant near Leo in Allen County. Junction Limestone, Inc. opened its Uland Quarry in Greene County; the quarry is a surface operation with plans to go underground depending on market conditions. Other significant openings include the following: Irving Gravel Co., Inc., Angola Pit, Steuben County; Elkhart County Gravel Corp., Middlebury Plant 2, Elkhart County; Stoneco, Inc., Milner Quarry, Miami County; Harco Sand and Gravel, Inc., Marion County; Purdy Materials Plant #1, Tippecanoe County; and Innovative Crushing and Aggregates, Inc., Clark County. Several other companies were set to begin operations, probably during 1999. Rieth-Riley Construction Co., Inc., Hunt Lake Pit, La Porte County closed in 1998.

The Indiana dimension limestone industry has been working at near capacity. Producers reported difficulty in meeting the demand for high-quality buff limestone. Bybee Stone Co. continued to work on repairs to the Iowa State Capital Building and plans to complete the 15-year project in 1999. The company received a contract for the Pope John Paul Cultural Center in Washington, DC. Evans Quarries, Inc. received contracts for several schools in Chicago, IL, and finished Federal courthouses in Sacramento; CA, Fargo, ND; and Tallahassee, FL. Indiana Limestone Co., Inc. provided limestone from the original Empire Hole at its P.M. and B. Quarry, Lawrence County, for major renovations on the Empire State Building in New York City. A new dimension sandstone company, Mansfield Stone, Inc., opened a quarry in old workings near Mansfield, Parke County.

[3]Kathryn Shaffer authored the text of State minerals information submitted by the Indiana Geological Survey.

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U.S. Gypsum Co. worked on a $90 million modernization and expansion of its East Chicago, Lake County, manufacturing plant with plans for completion by yearend 1999. The plant continues to use synthetic gypsum produced by electric utilities with fluidized gas desulfurization systems as well as gypsum from other sources. National Gypsum Co. began constructing a new plant in Rensselaer, Jasper County, to make reinforcing tapes, joint compounds, spray textures, and dry powders. Carmeuse Marblehead Lime Co. Buffington Plant, Lake County, made improvements to its kiln and baghouse that are expected to boost the plant's production.

Metals Industry

Based on preliminary figures compiled by the American Iron and Steel Institute, Indiana produced 21.7 million metric tons (24 million short tons) of steel during 1998 down from 22.9 million tons (25.2 million short tons) during 1997, a decrease of about 5.2%. The decrease was caused in part by large quantities of low-priced steel imports over which the industry filed complaints with the International Trade Commission and the U.S. Department of Commerce. Due to poor market conditions, Bethlehem Steel Corp. temporarily shut down its 203-centimeter (80-inch) hot strip mill at its Burns Harbor Division, Porter County, with the possibility of a layoff in 1999. Ispat International N.V. purchased Inland Steel Industries, Inc., Lake County, for $1.4 billion, making the company the seventh largest steel producer in the world. The company intends to sharply increase production at the plant, which was renamed Ispat Inland, Inc. Related steel-finishing businesses I/N Tek and I/N Kote will maintain their joint-venture status with Nippon Steel Corporation. Lukens Inc., which operated two plate steel mills in Burns Harbor, Porter County, and four other mills outside of Indiana, was acquired by Bethlehem Steel Corp. The new division is called Bethlehem Lukens Plate and the two Indiana mills were consolidated. Bethlehem Steel Corp. will sell its Burns Harbor No. 1 coke battery to DTE Energy Services, Inc., but will continue to use some coke from the battery for at least 9 years. USX-US Steel Group, Inc., Gary Works, Lake County, which celebrated 90 years of production in July, completed a new $40 million heat treating facility and related improvements at its 406-centimeter (160-inch) plate mill in May. The company spent $25 million and will spend $22 million more on plant renovations to correct and prevent further problems from wastewater emissions and will spend $55 million more to help clean up the Grand Calumet River. The Qualitech Steel Corp. minimill near Pittsboro, Hendricks County, and the $1.1 billion AK Steel Corp. plant at Rockport, Spencer County, were completed during the year. The AK Steel plant's cold mill is capable of processing 545 tons of carbon steel per hour. Construction began on a new Weirton Steel Corp. galvanizing plant in Jeffersonville, Clark County. Steel Dynamics, Inc. announced that a new $285 million structural steel mill will be built in Whitley County and will be ready for production in 2000. Detroit Steel announced that it would close its plant at Morristown, Shelby County, and move its operations to Mexico, but establish a small testing, engineering, and warehouse facility at the current site employing about 22 people. Approximately 230 are employed at the steel plant. Some companies were forced into partial shutdowns in June when a shortage in electricity caused electricity prices to soar up to $3,500 per megawatt hour.

Legislation and Government Programs

Indiana will receive $3.7 billion in Federal funds over 6 years under the Transportation Equity Act for the 21st Century signed by the President in June. The bill included $27 million for development of Interstate 69 in Indiana. The Indiana Department of Transportation decided to extend the environmental impact study for the project to include the entire distance between Indianapolis and Evansville, which will considerably delay the start of construction. No industrial minerals-related legislation passed the State legislature during calendar year 1998.

The Indiana Mineral Aggregates Association (IMAA) served on the national Coalition for Effective Miner Training to help the industry and the MSHA formulate new training regulations for noncoal, nonmetal mines. The new regulations should be finalized by October 1999. The IMAA has also been working to help establish self-regulated reclamation standards for the Indiana aggregates industry.

The Indiana Department of Environmental Management issued an air permit to Lehigh Portland Cement Co. in Mitchell, Lawrence County, allowing the company to burn tires for fuel. The company plans to burn about 2.5 million tires per year. Indiana became the first State in the nation to establish a State rule that limits the release of volatile organic compounds from steel sinter plants. The northwestern Indiana plants that would be affected cooperated with the Indiana Department of Environmental Management in the formation of the new standards which are designed to lower production of ozone in the northwestern part of the State.

The IGS discussed the possibility of participating with other State surveys and the USGS in an ongoing mineral resource study in the Great Lakes region as well as a new mineral resource study along the Ohio River corridor. The IGS completed a report on environmental planning in Monroe County (Hartke and Gray, 1998). Research continued on the geochemistry of industrial minerals, limestones for flue-gas desulfurization systems in coal-fired electric powerplants, heavy minerals in sand, a database of physical testing data for dimension limestones, and a database of abandoned sand and gravel pits.

Reference Cited

Harthe, E.J., and Gray, H.H., 1998, Geology for environmental planning in Monroe County, Indiana: Bloomington, IN, Indiana Geological Survey, Special Report 47, 38 p.

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TABLE 1
NONFUEL RAW MINERAL PRODUCTION IN INDIANA 1/ 2/

(Thousand metric tons and thousand dollars unless otherwise specified)

Mineral	1996 Quantity	1996 Value	1997 Quantity	1997 Value	1998 p/ Quantity	1998 p/ Value
Cement: Portland	2,350	153,000 e/	2,400	168,000 e/	2,480	178,000
Clays:						
Ball	38	W	--	--	--	--
Common	1,510	3,500	947	2,040	966	2,090
Gemstones	NA	3	NA	3	NA	3
Sand and gravel: Construction	24,800	100,000	21,900	93,100	23,600	103,000
Stone:						
Crushed 3/	53,700	254,000	59,000	280,000	60,800	289,000
Dimension 3/ metric tons	156,000	24,500	190,000	24,900	192,000	24,700
Combined values of cement (masonry), gypsum (crude), lime, peat, sand and gravel (industrial), stone (crushed slate, dimension dolomite), and values indicated by symbol W	XX	92,800	XX	101,000	XX	103,000
Total	XX	628,000	XX	670,000	XX	700,000

e/ Estimated. p/ Preliminary. NA Not available. W Withheld to avoid disclosing company proprietary data; value included with "Combined values" data.
XX Not applicable.
1/ Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
2/ Data are rounded to three significant digits; may not add to totals shown.
3/ Excludes certain stones; kind and value included with "Combined values" data.

TABLE 2
INDIANA: CRUSHED STONE SOLD OR USED, BY KIND 1/

Kind	1996 Number of quarries	1996 Quantity (thousand metric tons)	1996 Value (thousands)	1996 Unit value	1997 Number of quarries	1997 Quantity (thousand metric tons)	1997 Value (thousands)	1997 Unit value
Limestone 2/	75	46,500	$217,000	$4.66	82	51,900	$242,000	$4.67
Dolomite	14	7,170	37,400	5.22	13	7,170	38,300	5.35
Slate	1	(3/)	(3/)	(3/)	1	(3/)	(3/)	(3/)
Total	XX	53,700	254,000	4.73	XX	59,000	280,000	4.75

XX Not applicable.
1/ Data are rounded to three significant digits; may not add to totals shown.
2/ Includes limestone-dolomite reported with no distinction between the two.
3/ Excludes slate from State total to avoid disclosing company proprietary data.

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TABLE 3
INDIANA: CRUSHED STONE SOLD OR USED BY PRODUCERS
IN 1997, BY USE 1/ 2/

Use	Quantity (thousand metric tons)	Value (thousands)	Unit value
Coarse aggregate (+1 1/2 inch):			
Macadam	161	$945	$5.87
Riprap and jetty stone	1,480	6,610	4.46
Filter stone	246	1,280	5.20
Other coarse aggregate	375	1,670	4.46
Coarse aggregate, graded:			
Concrete aggregate, coarse	5,190	19,200	3.71
Bituminous aggregate, coarse	4,310	17,400	4.04
Bituminous surface-treatment aggregate	2,440	8,950	3.67
Railroad ballast	276	1,310	4.76
Fine aggregate (-3/8 inch):			
Stone sand, concrete	203	979	4.82
Stone sand, bituminous mix or seal	294	2,200	7.47
Screening, undesignated	134	568	4.24
Other fine aggregate	272	1,480	5.43
Coarse and fine aggregates:			
Graded road base or subbase	5,120	25,600	5.01
Unpaved road surfacing	3,890	19,800	5.08
Terrazzo and exposed aggregate	W	W	4.00
Crusher run or fill or waste	1,140	4,070	3.58
Other coarse and fine aggregates	1,820	9,490	5.21
Agricultural:			
Agricultural limestone	1,600	6,730	4.20
Other agricultural uses	(3/)	(3/)	4.44
Chemical and metallurgical:			
Cement manufacture	3,690	7,670	2.08
Dead-burned dolomite manufacture	(3/)	(3/)	4.64
Flux stone	(3/)	(3/)	4.19
Sulfur oxide removal	(3/)	(3/)	4.03
Special:			
Asphalt fillers or extenders	(3/)	(3/)	7.71
Whiting or whiting substitute	(3/)	(3/)	10.71
Other specified uses not listed	(3/)	(3/)	3.30
Unspecified: 4/			
Actual	18,000	96,000	5.32
Estimated	7,710	45,600	5.91
Total	59,000	280,000	4.75

W Withheld to avoid disclosing company proprietary data; included with "Other coarse and fine aggregates."
1/ Includes dolomite, limestone, and limestone-dolomite; excludes slate from State total to avoid disclosing company proprietary data.
2/ Data are rounded to three significant digits, except unit value; may not add to totals shown.
3/ Withheld to avoid disclosing company proprietary data; included in "Total."
4/ Includes reported and estimated production without a breakdown by end use.

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TABLE 4

INDIANA: CRUSHED STONE SOLD OR USED BY PRODUCERS IN 1997, BY USE AND DISTRICT 1/ 2/

(Thousand metric tons and thousand dollars)

Use	District 1		District 2		District 3	
	Quantity	Value	Quantity	Value	Quantity	Value
Construction aggregates:						
Coarse aggregate (+1 1/2 inch) 3/	550	2,820	782	3,620	932	4,070
Coarse aggregate, graded 4/	2,280	11,100	1,390	7,610	8,530	28,200
Fine aggregate (-3/8 inch) 5/	W	W	470	3,040	238	1,220
Coarse and fine aggregate 6/	6,960	32,400	2,690	14,100	2,320	12,400
Agricultural 7/	676	3,230	290	1,450	645	2,100
Chemical and metallurgical 8/	W	W	W	W	2,400	6,880
Special 9/	--	--	W	W	W	W
Other miscellaneous use 10/	W	W	--	--	W	W
Unspecified: 11/						
Actual	W	W	9,350	49,600	6,220	28,800
Estimated	2,460	11,800	4,270	28,900	976	4,830
Total	16,400	81,200	20,300	110,000	22,400	88,900

W Withheld to avoid disclosing company proprietary data; included in "Total."
1/ Excludes slate from State total to avoid disclosing company proprietary data.
2/ Data are rounded to three significant digits; may not add to totals shown.
3/ Includes filter stone, macadam, riprap and jetty stone, and other coarse aggregate.
4/ Includes concrete aggregate (coarse), bituminous aggregate (coarse), bituminous surface-treatment aggregate, railroad ballast.
5/ Includes stone sand (concrete), stone sand (bituminous mix or seal), screening (undesignated), and other fine aggregate.
6/ Includes graded road base or subbase, terrazzo and exposed aggregate, unpaved road surfacing, crusher run (select material or fill), and other coarse and fine aggregates.
7/ Includes agricultural limestone and other agricultural uses.
8/ Includes cement manufacture, dead-burned dolomite manufacture, flux stone, and sulfur oxide removal.
9/ Includes asphalt fillers or extenders and whiting or whiting substitute.
10/ Includes other specified uses not listed.
11/ Includes reported and estimated production without a breakdown by end use.

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TABLE 5
INDIANA: CONSTRUCTION SAND AND GRAVEL SOLD OR USED IN 1997,
BY MAJOR USE CATEGORY 1/

Use	Quantity (thousand metric tons)	Value (thousands)	Value per ton
Concrete aggregate (including concrete sand)	5,860	$23,900	$4.08
Plaster and gunite sands	88	517	5.88
Concrete products (blocks, bricks, pipe, decorative, etc.)	237	1,490	6.27
Asphaltic concrete aggregates and other bituminous mixtures	1,510	5,430	3.59
Road base and coverings 2/	2,220	10,400	4.70
Fill	2,570	9,350	3.64
Filtration	39	321	8.23
Snow and ice control	298	898	3.01
Other miscellaneous uses 3/	224	1,050	4.69
Unspecified: 4/			
Actual	7,380	33,400	4.52
Estimated	1,520	6,370	4.20
Total or average	21,900	93,100	4.24

1/ Data are rounded to three significant digits; may not add to totals shown.
2/ Includes road and other stabilization (cement).
3/ Includes railroad ballast and roofing granules.
4/ Includes reported and estimated production without a breakdown by end use.

TABLE 6
INDIANA: CONSTRUCTION SAND AND GRAVEL SOLD OR USED IN 1997,
BY USE AND DISTRICT 1/

(Thousand metric tons and thousand dollars)

	District 1		District 2		District 3		Unspecified districts	
Use	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
Concrete aggregates	1,560	5,300	2,840	14,900	1,450	3,740	--	--
Concrete products 2/	84	661	129	997	111	345	--	--
Asphaltic concrete aggregates	757	3,120	223	801	533	1,500	--	--
Road base materials 3/	398	1,630	1,540	7,830	277	968	--	--
Fill	338	1,090	1,470	6,880	465	1,050	299	329
Other miscellaneous uses 4/	371	1,590	149	469	42	210	--	--
Unspecified: 5/								
Actual	176	1,230	4,990	23,400	2,210	8,780	--	--
Estimated	889	3,980	220	669	408	1,730	--	--
Total	4,570	18,600	11,600	55,900	5,490	18,300	299	329

1/ Data are rounded to three significant digits; may not add to totals shown.
2/ Includes plaster and gunite sands.
3/ Includes road and other stabilization (cement).
4/ Includes filtration, railroad ballast, and snow and ice control.
5/ Includes reported and estimated production without a breakdown by end use.

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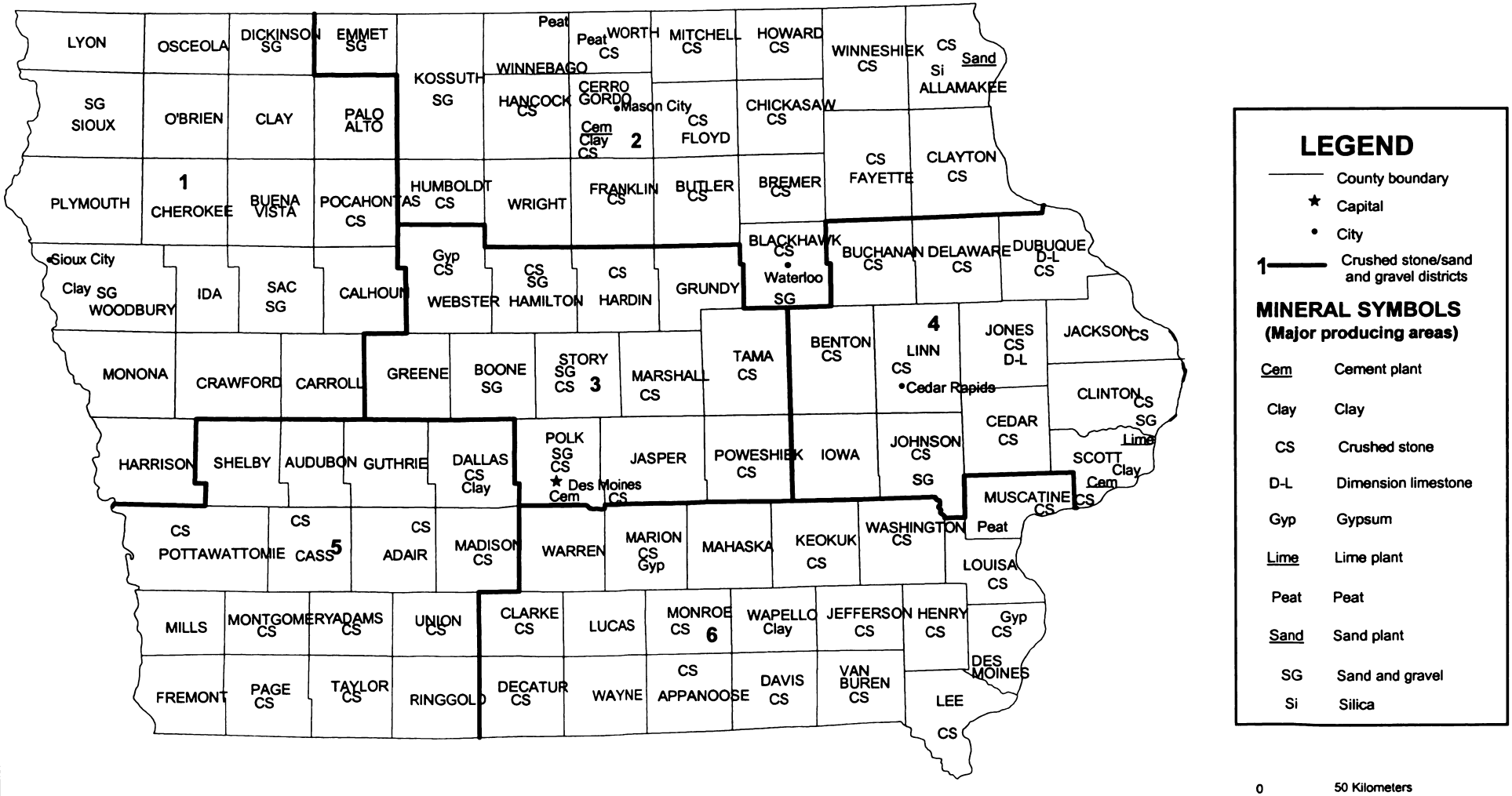
IOWA



LEGEND

- County boundary
- ★ Capital
- • City
- 1 Crushed stone/sand and gravel districts

MINERAL SYMBOLS
(Major producing areas)

Cem	Cement plant
Clay	Clay
CS	Crushed stone
D-L	Dimension limestone
Gyp	Gypsum
Lime	Lime plant
Peat	Peat
Sand	Sand plant
SG	Sand and gravel
Si	Silica

0 50 Kilometers

Source: Iowa Geological Survey Bureau/U.S. Geological Survey (1998)

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THE MINERAL INDUSTRY OF IOWA

This chapter has been prepared under a Memorandum of Understanding between the U.S. Geological Survey and the Iowa Geological Survey Bureau for collecting information on all nonfuel minerals.

In 1998, the preliminary estimated value[1] of nonfuel mineral production was $524 million, according to the U.S. Geological Survey (USGS). This was almost an 8% increase from that of 1997,[2] and followed a 5.7% increase in 1997 from that of 1996. Iowa rose in rank to 28th from 30th among the 50 States in total nonfuel mineral.production value, of which the State accounted for more than 1% of the U.S. total.

Crushed stone remained the leading commodity, accounting for about 45% of the State's total nonfuel mineral value, followed by portland cement with more than 39% and construction sand and gravel with more than 10%. Most of Iowa's increase in value in 1998 resulted from the increases in crushed stone, $19 million, and portland cement, $11 million, and was further supported by smaller yet significant increases in crude gypsum and construction sand and gravel (table 1). Only peat decreased (marginally). In 1997, the increased values of portland cement up $18 million, and crushed stone up $13 million, accounted for most of the State's $26 million increase.

Compared with USGS preliminary estimates of quantities produced in the other 49 States in 1998, Iowa remained 3d[2] in crude gypsum and 10th in portland cement. Additionally, the State was a significant producer of crushed stone and construction sand and gravel. No metals were mined in Iowa; all of the State's metal production, such as raw steel, resulted from the processing of materials acquired from other domestic and foreign sources.

The Geological Survey Bureau (GSB) of the Iowa Department of Natural Resources provided the following narrative information.[3] In 1998, Iowa recorded 240 licensed mineral producers operating 1,070 registered mineral production sites in a total of 97 counties. Of the 240 licensed producers, 9 had regional offices based outside of Iowa and 31 were Iowa county governments.

The 31 licensed county governments operated a total of 113 registered sites. Of the county-operated sites, 13 produced crushed stone, 100 produced sand and gravel, and 1 of those operations produced both crushed stone and sand and gravel. Five counties operated crushed stone quarries, and Fayette County, with eight registered sites, operated the greatest number of county-licensed quarries. The other 26 county governments operated sand and gravel pits, and Kossuth County, with 10 registered sites, operated the greatest number of county- licensed sand and gravel pits.

The greatest number of registered sites and the widest production distribution in any product class was in sand and gravel. Sand and gravel was produced in 86 counties from a total of 602 registered sites. Western Iowa, with its deeply buried bedrock, hosted the top 10 counties in terms of the number of sand and gravel sites. These top 10 western counties had 191 active sand and gravel pits representing slightly more than 30% of the total number of active sand and gravel pits statewide. Sac County, with 25 registered sand and gravel pits, had the greatest number of sand and gravel production sites of all the counties statewide. Hallett Materials Co. operated the greatest number of sand and gravel sites with a total of 52 sites spread across 21 counties.

Crushed stone (mined exclusively from sedimentary limestone or dolostone strata) was produced from 462 registered sites distributed across 66 counties. Of these 462 crushed stone sites, 9 were underground mine operations. Northeastern Iowa, with its readily accessible shallow bedrock, hosted 9 of the top 10 counties in terms of their number of crushed stone sites. These top 9 northeastern counties had 227 active quarries, representing 49% of the total number of active crushed stone production sites statewide. Winneshiek County, with 40 registered quarries, had the greatest number of crushed stone sites of all counties statewide. Wendling Quarries, Inc. operated the greatest number of quarries with a total of 61 sites spread across 10 counties, while Martin Marietta Materials Inc. operated the greatest number of underground mines with 3 mines in 3 separate counties (Story, Webster, and Poweshiek Counties). Martin Marietta Aggregates of Southeast Iowa, Inc., a new licensee in 1997, continued operational control over one underground limestone mine, the Durham Mine in Marion County. The Schildberg Construction Co., Inc. of Greenfield, IA, completed its first full year of production at the Atlantic underground limestone mine in Cass County. The operation of the Atlantic Mine, which Schildberg commenced in 1997, is comprised of a 5-meter face, room and pillar style, in the Bethany Falls Limestone. This is the first and only underground mine in the State to operate in the Pennsylvanian age limestones of southwest Iowa.

Crude gypsum was produced in 3 counties by 5 companies operating at a total of 14 sites. The United States Gypsum

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[1]The terms "nonfuel mineral production" and related "values" encompass variations in meaning, depending on the minerals or mineral products. Production may be measured by mine shipments, mineral commodity sales, or marketable production (including consumption by producers) as is applicable to the individual mineral commodity.

All 1998 USGS mineral production data published in this chapter are preliminary estimates as of February 1999 and are expected to change. For some mineral commodities (for example, construction sand and gravel, crushed stone, and portland cement), estimates are updated periodically. To obtain the most current information, please contact the appropriate USGS mineral commodity specialist. A telephone listing for the specialists may be retrieved over the Internet at http://minerals.usgs.gov/minerals/contacts/comdir.html; by using MINES FaxBack at (703) 648-4999 from a fax machine with a touch-tone handset (request Document #1000 for a telephone listing of all mineral commodity specialists); or by calling USGS information at (703) 648-4000 for the specialist's name and number. All Mineral Industry Surveys—mineral commodity, State, and country—also may be retrieved over the Internet at http://minerals.usgs.gov/minerals; facsimile copies may be obtained from MINES FaxBack.

[2]Values, percentage calculations, and rankings for 1997 may vary from the *Minerals Yearbook, Area Reports: Domestic 1997, Volume II*, owing to the revision of preliminary 1997 to final 1997 data. Data for 1998 are preliminary and expected to change, while related rankings may also be subject to change.

[3]Robert McKay, Research Geologist, authored the text of minerals industry information provided by the Iowa Geological Survey Bureau.

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Co., having the largest number of production sites, operated 7 of these 14 sites, with 6 quarries (categorized as 1 site in the USGS database) in Webster County and 1 underground mine in Des Moines County. Webster County remained the leader in terms of the number of gypsum operations, with 12 quarries operated by 3 different companies. Georgia Pacific Corp. continued supplying its board plant with gypsum rock from National Gypsum Co.'s Kaufmann-George Quarry in the northern part of the district. Georgia Pacific, which discontinued mining operations at its Elkhorn Township Quarry in 1997 because of inadequate reserves, had been a longtime producer of gypsum rock in Webster County.

Clay was produced at 11 sites in 6 counties by 7 different companies. Clay used in the manufacture of portland cement was mined at 6 pits in Cerro Gordo and Scott Counties, and clay used for other clay products (primarily brick) was taken from four pits in Dallas, Woodbury, and Webster Counties. Clay material was mined at one registered site for fill material.

The GSB completed a new open file map entitled *Potential Aggregate Resources of Linn County*. The map, prepared at a scale of 1:100,000, delineates areas of potential sand and gravel resources and of shallow bedrock suitable for quarrying. The map is available from the GSB.

TABLE 1
NONFUEL RAW MINERAL PRODUCTION IN IOWA 1/ 2/

(Thousand metric tons and thousand dollars unless otherwise specified)

Mineral	1996 Quantity	1996 Value	1997 Quantity	1997 Value	1998 p/ Quantity	1998 p/ Value
Cement: Portland	2,390	177,000 e/	2,550	195,000 e/	2,640	206,000
Clays: Common	478	1,180	287	976	293	996
Gemstones	NA	481	NA	91	NA	91
Gypsum, crude	2,090	12,800	2,080	12,200	2,070	14,900
Sand and gravel: Construction	13,300	54,600	12,600	51,300	13,000	54,700
Stone: Crushed	34,400	202,000	37,300	215,000	40,400	234,000
Combined values of cement (masonry), lime, peat, sand and gravel (industrial)	XX	11,100	XX	12,500	XX	13,500
Total	XX	460,000	XX	486,000	XX	524,000

e/ Estimated. p/ Preliminary. NA Not available. XX Not applicable.
1/ Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
2/ Data are rounded to three significant digits; may not add to totals shown.

TABLE 2
IOWA: CRUSHED STONE SOLD OR USED, BY KIND 1/

Kind	1996 Number of quarries	1996 Quantity (thousand metric tons)	1996 Value (thousands)	1996 Unit value	1997 Number of quarries	1997 Quantity (thousand metric tons)	1997 Value (thousands)	1997 Unit value
Limestone 2/	208	34,400	$202,000	$5.88	198	37,200	$215,000	$5.77
Dolomite	3	42	169	4.02	1	41	141	3.44
Total	XX	34,400	202,000	5.88	XX	37,300	215,000	5.76

XX Not applicable.
1/ Data are rounded to three significant digits; may not add to totals shown.
2/ Includes limestone-dolomite reported with no distinction between the two.

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TABLE 3
IOWA: CRUSHED STONE SOLD OR USED BY PRODUCERS
IN 1997, BY USE 1/ 2/

Use	Quantity (thousand metric tons)	Value (thousands)	Unit value
Coarse aggregate (+1 1/2 inch):			
Macadam	279	$1,320	$4.73
Riprap and jetty stone	112	883	7.88
Filter stone	533	1,730	3.25
Other coarse aggregate	43	336	7.81
Coarse aggregate, graded:			
Concrete aggregate, coarse	1,520	9,370	6.18
Bituminous aggregate, coarse	663	3,730	5.62
Bituminous surface-treatment aggregate	210	1,350	6.43
Other graded coarse aggregate 3/	212	1,180	5.57
Fine aggregate (-3/8 inch):			
Stone sand, concrete	81	625	7.72
Stone sand, bituminous mix or seal	180	708	3.93
Screening, undesignated	164	721	4.40
Coarse and fine aggregates:			
Graded road base or subbase	1,710	8,720	5.11
Unpaved road surfacing	4,610	22,000	4.77
Terrazzo and exposed aggregate	7	16	2.29
Crusher run or fill or waste	416	1,150	2.76
Other coarse and fine aggregates	11	47	4.27
Other construction materials	209	793	3.79
Agricultural:			
Agricultural limestone	844	3,410	4.04
Other agricultural uses	W	W	13.43
Chemical and metallurgical:			
Cement manufacture	3,250	23,000	7.09
Lime manufacture	W	W	4.29
Flux stone	W	W	6.42
Glass manufacture	W	W	12.37
Special:			
Asphalt fillers or extenders	W	W	14.75
Roofing granules	W	W	7.72
Unspecified: 4/			
Actual	11,000	69,600	6.34
Estimated	10,400	58,300	5.62
Total	37,300	215,000	5.76

W Withheld to avoid disclosing company proprietary data; included in "Total."
1/ Includes dolomite, limestone, and limestone-dolomite.
2/ Data are rounded to three significant digits, except unit value; may not add to totals shown.
3/ Includes railroad ballast.
4/ Includes reported and estimated production without a breakdown by end use.

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TABLE 4
IOWA: CRUSHED STONE SOLD OR USED BY PRODUCERS IN 1997, BY USE AND DISTRICT 1/

(Thousand metric tons and thousand dollars)

Use	District 1		District 2		District 3		District 4	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
Construction aggregates:								
Coarse aggregate (+1 1/2 inch) 2/	--	--	91	467	W	W	717	2,980
Coarse aggregate, graded 3/	--	--	573	3,660	W	W	1,430	8,420
Fine aggregate (-3/8 inch) 4/	--	--	81	352	W	W	216	1,090
Coarse and fine aggregate 5/	--	--	1,690	8,650	198	1	3,160	12,400
Other construction materials	--	--	W	W	W	W	W	W
Agricultural 6/	--	--	281	1,410	W	W	363	1,660
Chemical and metallurgical 7/	--	--	W	W	--	--	W	W
Special 8/	--	--	--	--	--	--	W	W
Unspecified: 9/								
Actual	W	W	W	W	W	W	W	W
Estimated	W	W	W	W	W	W	W	W
Total	1,120	7,360	8,070	54,700	5,320	35,500	10,700	45,600

Use	District 5		District 6		Unspecified districts	
	Quantity	Value	Quantity	Value	Quantity	Value
Construction aggregates:						
Coarse aggregate (+1 1/2 inch) 2/	--	--	133	1	--	--
Coarse aggregate, graded 3/	--	--	508	3,260	--	--
Fine aggregate (-3/8 inch) 4/	--	--	125	1	--	--
Coarse and fine aggregate 5/	--	--	1,830	10,900	--	--
Other construction materials	--	--	W	W	--	--
Agricultural 6/	--	--	168	1	--	--
Chemical and metallurgical 7/	--	--	--	--	--	--
Special 8/	--	--	--	--	--	--
Unspecified: 9/						
Actual	W	W	W	W	913	6,190
Estimated	W	W	W	W	--	--
Total	6,050	36,600	5,100	28,800	913	6,190

W Withheld to avoid disclosing company proprietary data; included in "Total."
1/ Data are rounded to three significant digits; may not add to totals shown.
2/ Includes filter stone, macadam, riprap and jetty stone, and other coarse aggregate.
3/ Includes concrete aggregate (coarse), bituminous aggregate (coarse), bituminous surface-treatment aggregate, railroad ballast, and other graded coarse aggregate.
4/ Includes stone sand (concrete), stone sand (bituminous mix or seal), screening (undesignated).
5/ Includes graded road base or subbase, terrazzo and exposed aggregate, unpaved road surfacing, crusher run (select material or fill) and other coarse and fine aggregates.
6/ Includes agricultural limestone and other agricultural uses.
7/ Includes cement manufacture, lime manufacture, and flux stone.
8/ Includes asphalt fillers or extenders and other uses.
9/ Includes reported and estimated production without a breakdown by end use.

TABLE 5
IOWA: CONSTRUCTION SAND AND GRAVEL SOLD OR USED IN 1997,
BY MAJOR USE CATEGORY 1/

Use	Quantity (thousand metric tons)	Value (thousands)	Value per ton
Concrete aggregate (including concrete sand)	2,380	$10,100	$4.24
Plaster and gunite sands	52	299	5.75
Concrete products (blocks, bricks, pipe, decorative, etc.)	86	817	9.50
Asphaltic concrete aggregates and other bituminous mixtures	594	2,110	3.55
Road base and coverings	1,890	5,080	2.69
Fill	959	2,470	2.58
Snow and ice control	84	296	3.52
Other miscellaneous uses 2/	57	482	8.46
Unspecified: 3/			
Actual	2,660	14,400	5.39
Estimated	3,800	15,300	4.02
Total or average	12,600	51,300	4.08

1/ Data are rounded to three significant digits; may not add to totals shown.
2/ Includes railroad ballast and roofing granules.
3/ Includes reported and estimated production without a breakdown by end use.

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TABLE 6
IOWA: CONSTRUCTION SAND AND GRAVEL SOLD OR USED IN 1997,
BY USE AND DISTRICT 1/

(Thousand metric tons and thousand dollars)

Use	District 1		District 2		District 3	
	Quantity	Value	Quantity	Value	Quantity	Value
Concrete aggregate	446	2,140	450	2,070	175	638
Concrete products 2/	28	164	39	527	W	W
Asphaltic concrete aggregates	171	660	81	392	290	781
Road base and coverings	760	2,280	W	W	603	1,670
Fill	307	898	71	209	107	288
Snow and ice control	W	W	29	132	24	87
Other miscellaneous uses 3/	W	W	24	285	W	W
Unspecified: 4/						
Actual	927	6,350	W	W	W	W
Estimated	965	3,050	441	2,030	2,170	9,280
Total	3,640	15,600	1,960	8,190	4,230	17,100

	District 4		District 5		District 6	
	Quantity	Value	Quantity	Value	Quantity	Value
Concrete aggregate	816	3,130	--	--	489	2,100
Concrete products 2/	34	200	--	--	W	W
Asphaltic concrete aggregates	W	W	--	--	W	W
Road base and coverings	--	--	W	W	W	W
Fill	129	328	--	--	345	747
Snow and ice control	W	W	--	--	--	--
Other miscellaneous uses 3/	--	--	W	W	W	W
Unspecified: 4/						
Actual	278	942	--	--	W	W
Estimated	93	381	128	540	--	--
Total	1,390	5,090	,196	,801	1,150	4,430

W Withheld to avoid disclosing company proprietary data; included in "Total."
1/ Data are rounded to three significant digits; may not add to totals shown.
2/ Includes plaster and gunite sands.
3/ Includes railroad ballast and roofing granules.
4/ Includes reported and estimated production without a breakdown by end use.

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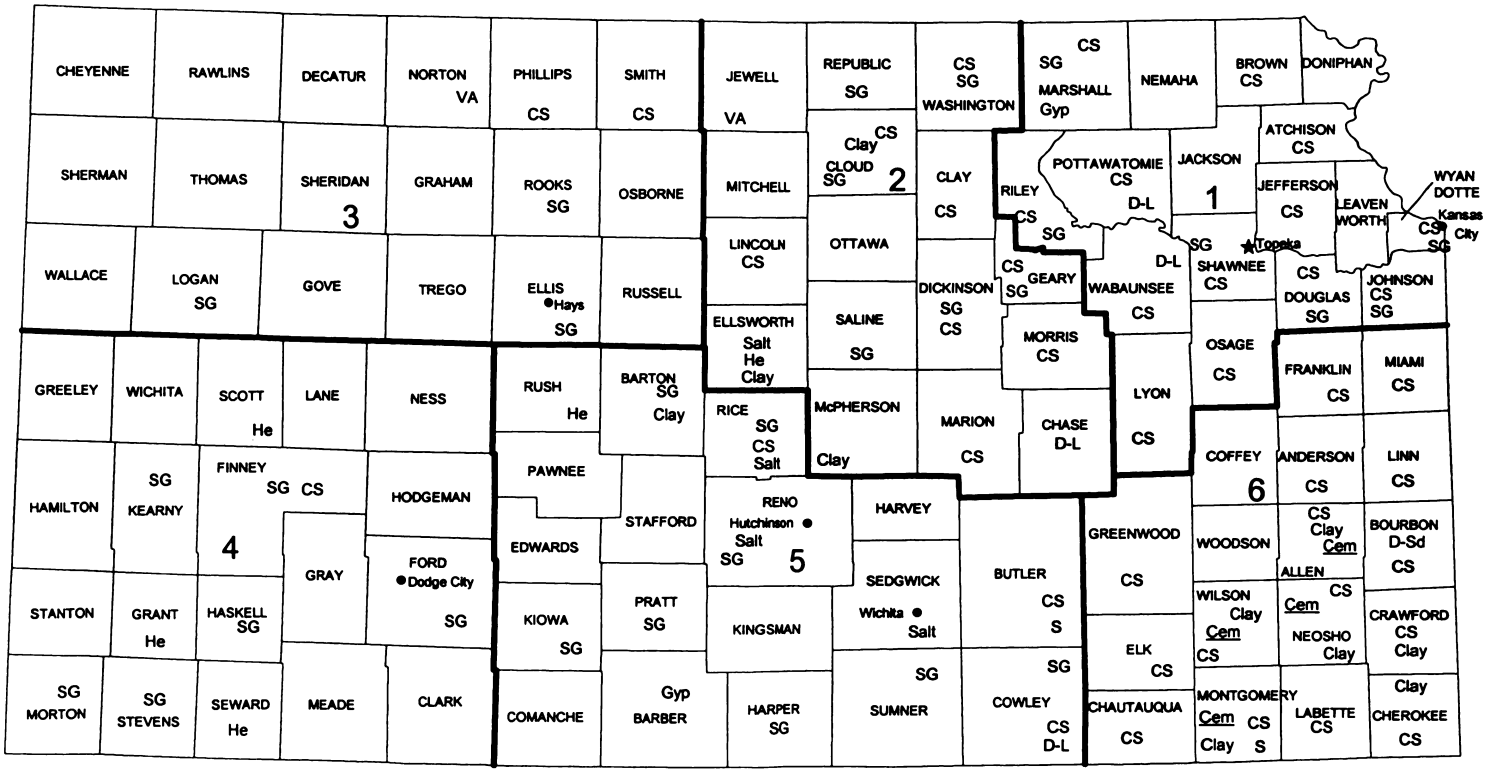
KANSAS



LEGEND

- County boundary
- ★ Capital
- ● City
- 1 — Crushed stone/sand and gravel districts

MINERAL SYMBOLS
(Major producing areas)

Cem	Cement plant
Clay	Clay
CS	Crushed stone
D-L	Dimension limestone
D-Sd	Dimension sandstone
Gyp	Gypsum
He	Helium
VA	Volcanic ash
S	Sulfur
Salt	Salt
SG	Sand and gravel

0 50 Kilometers

Source: Kansas Geological Survey/U.S. Geological Survey (1998)

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THE MINERAL INDUSTRY OF KANSAS

This chapter has been prepared under a Memorandum of Understanding between the U.S. Geological Survey and the Kansas Geological Survey for collecting information on all nonfuel minerals.

In 1998, the preliminary estimated value[1] of nonfuel mineral production for Kansas was $535 million, according to the U.S. Geological Survey (USGS). This was a marginal decrease from that of 1997,[2] following a 1.7% increase from 1996 to 1997. The State decreased in rank from 25th to 27th among the 50 States in total nonfuel mineral production value, of which Kansas accounted for more than 1% of the U.S. total.

Portland cement, salt, grade-A helium, and crushed stone were Kansas' leading nonfuel mineral commodities, accounting for about 24%, 23%, 20%, and 19%, respectively, of the State's total nonfuel mineral production value. In 1998, increases in the values of portland cement, grade-A helium, and salt were less than enough to balance out the drops in crushed stone and construction sand and gravel values, resulting in a small net decrease (table 1). (All mineral commodity listings are by descending order of value or change in value.) The State's other nonfuel minerals increased in value, except crude gypsum, dimension stone, and fuller's earth, which showed small decreases; gemstones remained the same. In 1997, moderate to small increases in crushed stone, portland cement, salt, and crude gypsum were partly mitigated by decreases in grade-A helium and pumice and pumicite; all other nonfuel minerals changed by relatively small amounts (table 1).

Production of nonfuel minerals in Kansas consisted entirely of industrial minerals; no metals were mined in the State. Based on USGS estimates of the quantities produced in the 50 States, Kansas continued as the Nation's leading[2] producer of crude and grade-A helium and remained fourth in salt. Additionally, significant quantities of portland cement, crushed stone, crude gypsum, common clays, and dimension stone were produced in the State.

[1]The terms "nonfuel mineral production" and related "values" encompass variations in meaning, depending on the minerals or mineral products. Production may be measured by mine shipments, mineral commodity sales, or marketable production (including consumption by producers) as is applicable to the individual mineral commodity.

All 1998 USGS mineral production data published in this chapter are preliminary estimates as of February 1999 and are expected to change. For some mineral commodities (for example, construction sand and gravel, crushed stone, and portland cement), estimates are updated periodically. To obtain the most current information, please contact the appropriate USGS mineral commodity specialist. A telephone listing for the specialists may be retrieved over the Internet at http://minerals.usgs.gov/minerals/contacts/comdir.html; by using MINES FaxBack at (703) 648-4999 from a fax machine with a touch-tone handset (request Document #1000 for a telephone listing of all mineral commodity specialists); or by calling USGS information at (703) 648-4000 for the specialist's name and number. All Mineral Industry Surveys—mineral commodity, State, and country—also may be retrieved over the Internet at http://minerals.usgs.gov/minerals; facsimile copies may be obtained from MINES FaxBack.

[2]Values, percentage calculations, and rankings for 1997 may vary from the *Minerals Yearbook, Area Reports: Domestic 1997, Volume II*, owing to the revision of preliminary 1997 to final 1997 data. Data for 1998 are preliminary and expected to change, while related rankings may also be subject to change.

The following narrative information was provided by the Kansas Geological Survey[3] (KGS). Producers of construction-related commodities like sand and gravel, crushed stone, cement, and building stone reported another good year for business, owing to good economic conditions in Kansas and the country overall, as well as a well-funded highway-construction program. Whereas USGS preliminary data (table 1) showed that the tonnage of crushed stone and sand and gravel sold or used were not as large as in 1998, the Kansas Aggregate Producers Association (KAPA) in Topeka projected that final 1998 production figures would likely be similar to or only slightly less than those of 1997. While demand for sand and gravel remained strong, supplies appeared to be shrinking in the Kansas City area owing to the dredging restrictions in the Kansas River, a limited number of floodplain dredges in the Kansas City area, and the reluctance of some users to use Missouri River sand because of the presence of lignite. Barring a sudden change in the economy, producers projected that sales in 1999 would be approximately the same as in 1998.

Martin Marietta Materials, Inc. announced that they had acquired the limestone quarry at Ottawa, Franklin County, from the Fogle Quarry Co., Inc. This is a significant acquisition because it is the largest crushed stone quarry in Kansas with a production capacity of over 1.6 million metric tons per year. Shears, Inc. divided its construction and aggregate operations into two groups. The aggregate operations are now collectively named Couch Construction Materials. In regard to mergers and acquisitions, Walker Stone Co., headquartered in Chapman, acquired the 21st Street Quarry outside of Augusta from George M. Myers, Inc., of El Dorado. The quarry has been a major source of crushed stone for the Wichita area; no plans are underway to make any changes to the 21st Street's previous modes of operation. Both companies are long-term producers of crushed stone—Walker for over 50 years and Myers for over 40 years.

Industry Issues and Legislation

A number of significant issues were prominently under discussion, debate, and study within the State, and were actively addressed in the State legislature and the news media. Sand and gravel dredging of the Kansas River continued to be the most prominent news item in the industrial minerals sector throughout early 1998. At issue was the potential for recreation on the Kansas River and how river dredging might be affected. Throughout 1997 an interagency committee, the Kansas River Corridor Recreational Committee (mandated by the legislature) addressed the issue of recreational potential. The committee was composed of five State agencies

[3]David A. Grisafe, Industrial Minerals Specialist with the Kansas Geological Survey authored the text of minerals industry information submitted by that agency.

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(Commerce and Housing, Water Office, Wildlife and Parks, Biological Survey, and Geological Survey). All of the agencies favored allowing some degree of recreation along the entire river, but differed existed as to whether there should be recreation zones coexisting with commercial enterprises or restricted recreation zones that would exclude commercial activities. Near yearend, committee members decided to allow recreation on all of the river without selected sections being reserved for recreation only. However, this changed at the last meeting of 1997. All of the agencies except the KGS voted to set aside large parts of the river for recreation only. Additionally, the non-KGS committee members, wanted to require a recreational compatibility plan for all new dredging permits that would be approved by the agency overseeing recreation on the river, the State's Wildlife and Parks agency.

Throughout 1997, the KGS conducted its own study of the Kansas River, encompassing the development of the river corridor and possible impacts on the river-dredging industry. This study included the geology of the Kansas River corridor; the economically important industrial mineral resources, particularly sand and gravel; sediment transport; and characteristics of the river and floodplain that might favor river or floodplain dredging. Also studied were scenarios of restricted dredging, alternate sources of sand, and the increased transportation costs if other sources were used. The study, *The Kansas River Corridor—Its Geologic Setting, Land Use, Economic Geology, and Hydrology*, completed in January 1998 (KGS Open-file Report 98-2), is available through the Publications Sales Office of the KGS. Portions of the study dealing with industrial minerals were presented at the 1998 Annual Forum on the Geology of Industrial Minerals in Norman, OK, the proceedings of which will be published at a later date.

The KGS agreed with the concept of recreation zones but not the large zones proposed that excluded possible river dredging in areas of high population density and future large population growth. The final interagency committee recommendation did not define any area of the Kansas River as restricted to recreation use alone. The interagency committee report was submitted at the 1998 legislative session before House and Senate committees; the KGS submitted its study to the committees as additional information. A bill, termed by some as a compromise solution between the dredging industry and recreation proponents, was defeated at the end of the legislative session by a vote of 16-24.

Another important and controversial issue revolved around the scarcity of ground water in western Kansas and the pit dredges along the Arkansas River floodplain, particularly the amount of water evaporation from the pits and the resulting effects on the water-table elevation. Representatives from the KAPA and the Equus Beds Groundwater Management District #2 formed the Aggregate and Groundwater Resources Task Force and were given the charge to make recommendations to the legislature related to ground water resources and aggregate production. The group conducted monthly, day-long meetings from July 1997 through January 1998, and April 1998 through December 1998, in an attempt to identify the extent of the problem and to come up with a solution that would satisfy all parties, a goal that was almost completed by yearend. The task force addressed the issues of transferability of water rights, differentiation of regional aquifers from stream-channel aquifers, and development of regulatory language that recognized those various geological settings. In some cases, experts were brought in to discuss specific issues. An underlying major problem throughout the study was how to handle applications for dredging permits in areas where the ground water is already appropriated. The task force hoped to propose legislation early in the 1999 legislative session.

In 1997, one action taken by a County resulted in legislation being passed by the State legislature in 1998 to address it and similar situations. During 1997, Dickinson County attempted to impose a severance tax of $0.22 per metric ton ($0.20 per short ton) of stone aggregate produced in the county. Opposition was raised by county producers and by the KAPA largely because no other industry that hauls on county roads had a similar tax imposed. Local aggregate producers filed an injunction preventing the implementation of the tax. During the 1998 legislative session, a bill supported by the KAPA, and the Kansas Department of Transportation was introduced and passed, effectively barring counties from imposing this tax. Local aggregate producers intend to continue working with the county commissioners to develop a compromise solution for repairing the haul roads.

Government Programs

Kansas was in the final year of its 8-year comprehensive highway program. Enhanced Federal funding, in part from the Transportation Equity Act for the 21st Century (Public Law 105-178), which authorized funds for Federal aid for highways, highway safety programs, and transit programs, prompted the Governor to begin his Transportation 2000 Plan in June 1998. During the year, a series of 12 town meetings were held to obtain input from citizens, businesses, regions, and communities to form a list of perceived future transportation needs for the State.

As part of the Kansas Geological Survey's multiyear program to remap much of the State, active geologic mapping programs were underway in many counties, including Bourbon, Coffey, Comanche, Ford, Greenwood, Hamilton, Kearny, Labette, Leavenworth, Marshall, Republic, Sedgwick, Wilson, Woodson, and Wyandotte. Studies were completed for Greenwood, Leavenworth, and Labette Counties and the maps are scheduled for release in 1999.

A new directory of industrial-mineral producers was compiled using records from the KGS and the State Conservation Commission (KGS, Open-File Report 98-35). The new directory, arranged alphabetically by county, includes the commodity, name, address, and telephone number for each producer as well as the legal description for each operation. The directory is expected to be available on the Internet during 1999 at the KGS's web site: http://www.kgs.ukans.edu. A State map showing the locations of all pits and quarries was nearly complete at yearend. Additionally, the KGS was compiling an abandoned quarry list for the State that also will eventually be placed on the Internet. Completion of the list is expected during 1999.

Thirty-nine open-file reports covering a variety of topics were completed at the KGS during the year and are available at the KGS library. A publication listing all open-file reports through 1998 will be issued during early 1999. Titles of all open-file reports through 1996 are now on the KGS's web site

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and an updated list through 1998 will be placed there during 1999. Among recent KGS publications of interest are *Hydrogeology and Geochemistry of Glacial Deposits in Northeastern Kansas* (Bulletin 229) and *Lexicon of Geologic Names for Kansas (through 1995)* (Bulletin 231). Also issued was *Current Research in Earth Science, 1998,* (Bulletin 241), which includes a study of the "Distribution of the Bandera Shale of the Marmaton Group, Middle Pennsylvanian, of Southeastern Kansas." The State's only building sandstone, the Bandera Quarry Sandstone Member, is included.

TABLE 1
NONFUEL RAW MINERAL PRODUCTION IN KANSAS 1/ 2/

(Thousand metric tons and thousand dollars unless otherwise specified)

Mineral		1996 Quantity	1996 Value	1997 Quantity	1997 Value	1998 p/ Quantity	1998 p/ Value
Cement:							
Masonry		24	2,240 e/	W	W	W	W
Portland		1,730	120,000 e/	1,690	122,000 e/	1,750	129,000
Clays							
Common		548	2,250	545	2,500	556	2,550
Fuller's earth		64	W	W	W	W	W
Gemstones		NA	621	NA	291	NA	291
Helium: Grade-A	million cubic	53	104,000	51	101,000	53	106,000
Salt		2,950	118,000	3,210	120,000	3,230	121,000
Sand and gravel: Construction		11,500	31,300	11,200	31,600	9,750	28,300
Stone:							
Crushed		22,100	110,000	23,000	116,000	22,600	102,000
Dimension 3/	metric tons	21,400	2,100	21,000	1,710	22,000	1,550
Combined values of gypsum (crude), helium (crude), pumice and pumicite, sand and gravel (industrial), stone (dimension sandstone), and values indicated by symbol W		XX	40,600	XX	44,200	XX	45,300
Total		XX	530,000	XX	539,000	XX	535,000

e/ Estimated. p/ Preliminary. NA Not available. W Withheld to avoid disclosing company proprietary data; value included with "Combined values" data. XX Not applicable.
1/ Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
2/ Data are rounded to three significant digits; may not add to totals shown.
3/ Excludes certain stones; kind and value included with "Combined values" figure.

TABLE 2
KANSAS: CRUSHED STONE SOLD OR USED, BY KIND 1/

Kind	1996 Number of quarries	1996 Quantity (thousand metric tons)	1996 Value (thousands)	1996 Unit value	1997 Number of quarries	1997 Quantity (thousand metric tons)	1997 Value (thousands)	1997 Unit value
Limestone 2/	117	21,400	$108,000	$5.04	158	22,300	$114,000	$5.11
Sandstone and quartzite	2	W	W	W	3	W	W	W
Granite	1	W	W	W	1	W	W	W
Total	XX	22,100	110,000	4.96	XX	23,000	116,000	5.04

W Withheld to avoid disclosing company proprietary data; included in "Total." XX Not applicable.
1/ Data are rounded to three significant digits; may not add to totals shown.
2/ Includes "Limestone-dolomite" reported with no distinction between the two.

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TABLE 3
KANSAS: CRUSHED STONE SOLD OR USED
BY PRODUCERS IN 1997, BY USE 1/ 2/

Use	Quantity (thousand metric tons)	Value (thousands)	Unit value
Coarse aggregate (+1 1/2 inch):			
Riprap and jetty stone	130	$1,210	$9.28
Filter stone	93	622	6.69
Other coarse aggregate 3/	225	1,280	5.70
Coarse aggregate, graded:			
Concrete aggregate, coarse	166	1,330	7.99
Bituminous aggregate, coarse	538	4,430	8.24
Other graded coarse aggregate 4/	2,070	12,400	5.98
Fine aggregate (-3/8 inch):			
Stone sand, concrete	W	W	8.33
Stone sand, bituminous mix or seal	26	185	7.12
Screening, undesignated	109	419	3.84
Other fine aggregate 5/	279	1,010	3.61
Coarse and fine aggregate:			
Graded road base or subbase	1,150	5,460	4.77
Unpaved road surfacing	913	4,120	4.51
Crusher run or fill or waste	246	1,400	5.69
Other coarse and fine aggregates	803	3,770	4.70
Other construction materials	626	3,270	5.22
Agricultural:			
Agricultural limestone	333	1,530	4.58
Other agricultural uses	1	7	7.00
Chemical and metallurgical: Cement manufacture	2,000	8,260	4.12
Special: Roofing granules	(6/)	(6/)	(6/)
Other miscellaneous uses:			
Waste material	2	4	2.00
Other specified uses not listed	(6/)	(6/)	(6/)
Unspecified: 7/			
Actual	10,500	52,100	4.94
Estimated	2,590	12,300	4.73
Total	23,000	116,000	5.04

W Withheld to avoid disclosing company proprietary data; included with "Other construction materials."
1/ Includes granite, limestone, limestone-dolomite, and sandstone and quartzite.
2/ Data are rounded to three significant digits; may not add to totals shown.
3/ Includes macadam.
4/ Includes bituminous surface-treatment aggregate and railroad ballast.
5/ Includes stone sand (concrete).
6/ Withheld to avoid disclosing company proprietary data; included in "Total."
7/ Includes reported and estimated production without a breakdown by end use.

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TABLE 4

KANSAS: CRUSHED STONE SOLD OR USED BY PRODUCERS IN 1997,
BY USE AND DISTRICT 1/ 2/

(Thousand metric tons and thousand dollars)

Use	District 1		District 2		District 3		District 5		District 6	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
Construction aggregates:										
Coarse aggregate (+1 1/2 inch) 3/	W	W	113	1,000	--	--	(4/)	(4/)	188	1,110
Coarse aggregate, graded 5/	1,620	10,800	W	W	--	--	--	--	824	4,330
Fine aggregate (-3/8 inch) 6/	W	W	W	W	--	--	--	--	195	1
Coarse and fine aggregate 7/	681	4,070	W	W	(4/)	(4/)	(4/)	(4/)	973	4,470
Other construction materials 8/	222	1,270	1,260	7,660	--	--	--	--	602	3,150
Agricultural 9/	(4/)	(4/)	(4/)	(4/)	--	--	--	--	206	1
Chemical and metallurgical 10/	--	--	--	--	--	--	--	--	2,000	8,260
Other miscellaneous uses	--	--	--	--	--	--	--	--	(4/)	(4/)
Unspecified: 11/										
Actual	(4/)	(4/)	(4/)	(4/)	(4/)	(4/)	(4/)	(4/)	(4/)	(4/)
Estimated	799	4,230	--	--	--	--	--	--	1,790	8,030
Total	9,140	52,900	3,260	16,500	192	(4/)	1,050	3,660	9,370	42,500

W Withheld to avoid disclosing company proprietary data; included with "Other construction materials."
1/ No crushed stone was produced in District 4.
2/ Data are rounded to three significant digits; may not add to totals shown.
3/ Includes filter stone, macadam, riprap and jetty stone, and other coarse aggregate.
4/ Withheld to avoid disclosing company proprietary data; included in "Total."
5/ Includes concrete aggregate (coarse), bituminous aggregate (coarse), bituminous surface-treatment aggregate, railroad ballast, and other graded coarse aggregate.
6/ Includes stone sand (concrete), stone sand (bituminous mix or seal), screening (undesignated), and other fine aggregate.
7/ Includes graded road base or subbase, unpaved road surfacing, crusher run (select material or fill), and other coarse and fine aggregate.
8/ Includes waste material.
9/ Includes agricultural limestone and other agricultural uses.
10/ Includes cement manufacture.
11/ Includes reported and estimated production without a breakdown by end use.

TABLE 5
KANSAS: CONSTRUCTION SAND AND GRAVEL SOLD OR USED IN 1997,
BY MAJOR USE CATEGORY 1/

Use	Quantity (thousand metric tons)	Value (thousands)	Value per ton
Concrete aggregate (including concrete sand)	2,880	$8,100	$2.82
Plaster and gunite sands	224	950	4.24
Concrete products (blocks, bricks, pipe, decorative, etc.)	87	576	6.62
Asphaltic concrete aggregates and other bituminous mixtures	1,610	5,280	3.27
Road base and coverings	2,000	5,390	2.69
Road and other stabilization (cement and lime)	169	534	3.16
Fill	1,150	2,260	1.96
Snow and ice control	122	478	3.92
Other miscellaneous uses 2/	45	339	7.53
Unspecified: 3/			
Actual	791	1,880	2.38
Estimated	2,110	5,810	2.75
Total or average	11,200	31,600	2.82

1/ Data are rounded to three significant digits; may not add to totals shown.
2/ Includes railroad ballast and roofing granules.
3/ Includes reported and estimated production without a breakdown by end use.

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TABLE 6
KANSAS: CONSTRUCTION SAND AND GRAVEL SOLD OR USED IN 1997,
BY USE AND DISTRICT 1/

(Thousand metric tons and thousand dollars)

Use	District 1		District 2		District 3	
	Quantity	Value	Quantity	Value	Quantity	Value
Concrete aggregate and concrete products 2/	1,100	3,840	223	914	35	97
Asphaltic concrete 3/	456	1,680	122	437	W	W
Road base and coverings	196	1,090	191	621	494	904
Fill	215	654	W	W	W	W
Other miscellaneous uses 4/	W	W	W	W	W	W
Unspecified: 5/						
Actual	19	185	7	25	15	42
Estimated	W	W	105	213	--	--
Total	3,460	12,100	734	2,470	603	1,210

	District 4		District 5		District 6	
	Quantity	Value	Quantity	Value	Quantity	Value
Concrete aggregate and concrete products 2/	151	430	1,670	4,340	--	--
Asphaltic concrete 3/	W	W	891	2,490	--	--
Road base and coverings	170	762	607	1,780	--	--
Fill	124	266	718	1,070	--	--
Other miscellaneous uses 4/	W	W	57	139	--	--
Unspecified: 5/						
Actual	--	--	750	1,630	--	--
Estimated	W	W	288	750	15	39
Total	1,400	3,620	4,980	12,200	15	39

W Withheld to avoid disclosing company proprietary data; included in "Total."
1/ Data are rounded to three significant digits; may not add to totals shown.
2/ Includes plaster and gunite sands.
3/ Includes road and other stabilization (cement and lime).
4/ Includes railroad ballast, roofing granules, and snow and ice control.
5/ Includes reported and estimated production without a breakdown by end use.

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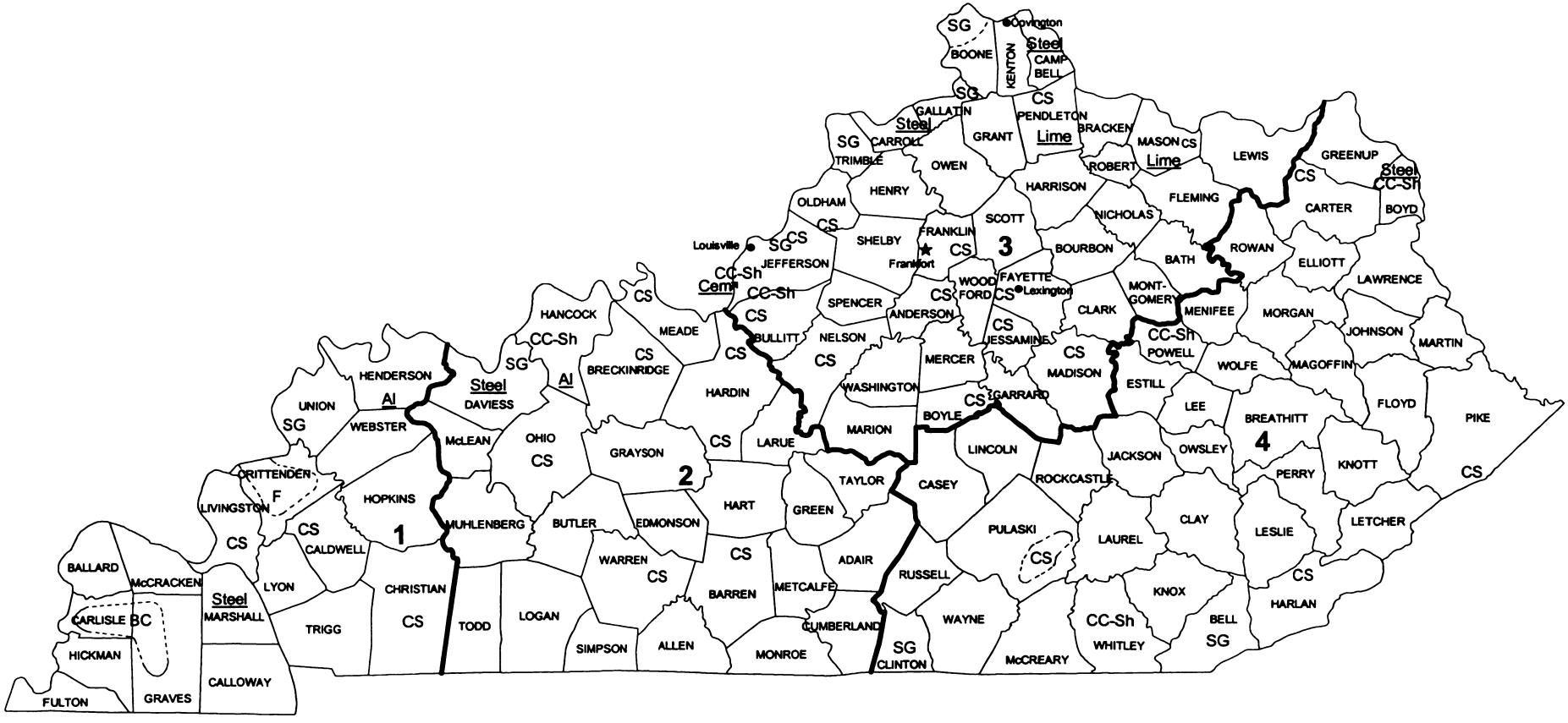
KENTUCKY



Source: Kentucky Geological Survey/U.S. Geological Survey (1998)

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THE MINERAL INDUSTRY OF KENTUCKY

This chapter has been prepared under a Memorandum of Understanding between the U.S. Geological Survey and the Kentucky Geological Survey for collecting information on all nonfuel minerals.

In 1998, the preliminary estimated value[1] of nonfuel mineral production for Kentucky was $489 million, according to the U.S. Geological Survey (USGS). This was about a 2% decrease from that of 1997,[2] and followed a 12.7% increase from 1996 to 1997. Kentucky remained 30th among the 50 States in total nonfuel mineral production value, of which the State accounted for more than 1% of the U.S. total.

Crushed stone continued as Kentucky's leading nonfuel mineral commodity in 1998, accounting for an estimated 58% of the State's nonfuel mineral production value. Lime was second and portland cement was third. In recent years, Kentucky has been entirely an industrial mineral-producing State. The last year in which any metal was mined in the State was 1990, when small quantities of zinc were mined. Kentucky's decrease in nonfuel mineral value in 1998 resulted mostly from $10 million and $3.2 million decreases, respectively, in the values of crushed stone and gemstones. These decreases were somewhat mitigated by increases in the values of portland cement and ball clay. All other nonfuel minerals showed small increases in value, except for a small decrease in construction sand and gravel. In 1997, the State's increase in value mostly resulted from increases in crushed stone, portland cement, and ball clay; all other minerals increased in value except gemstones and crushed sandstone.

Compared with USGS estimates of the quantities produced in the other 49 States during 1998, Kentucky remained one of the top four lime-producing States[2] and dropped from second to third in ball clays. Additionally, the State produced significant quantities of crushed stone and common clays. Primary aluminum and raw steel were produced from materials obtained from other domestic and foreign sources. Based on preliminary estimates, Kentucky remained the Nation's second leading producer of primary aluminum.

The following narrative information was provided by the Kentucky Geological Survey (KGS).[3] To furnish additional construction aggregate for growing urban markets in the Louisville metropolitan area and in northern Kentucky, two mines were opened to produce stone from limestone and dolomite of the High Bridge Group (Ordovician). Mines in the High Bridge rock unit sequence have been a major source of aggregate for the metropolitan Lexington market of central Kentucky and a source of feedstock for lime plants along the Ohio River in northern Kentucky.

In eastern Jefferson County (Louisville), The Rogers Group produced crushed stone from an open pit operation in the Laurel Dolomite (Silurian). During 1998, they received approval from the county Board of Zoning Adjustment to modify their quarry permit to move stone production and primary crushing underground. A slope is being driven down into the High Bridge Group, where stone will be produced from two levels. The depth of the lower level will be more than 300 meters below the surface.

In north central Kentucky, Sterling Materials Co. opened a mine in the High Bridge at a greenfield site in Gallatin County. The operation will supply aggregate for the northern Kentucky market.

Boone County Fiscal Court approved regulations for underground mining that were proposed by the county planning commission in response to a lawsuit filed by American Aggregates Corp. The lawsuit grew out of an attempt by American Aggregates to develop an underground mine in northern Kentucky to produce stone from the High Bridge Group. The owner of American Aggregates, Martin Marietta Aggregates, indicated that they planned to challenge the reasonableness of the regulations (Charley, 1998). Martin Marietta continues to work toward obtaining approval for the underground mine and the lawsuit is still outstanding.

The Lexington Cut Stone, Marble & Tile Co. supplied about 545 metric tons of dimension limestone for refacing walls at the Keeneland Race Course in Fayette County. The stone was produced from the Tyrone Limestone, the uppermost formation in the High Bridge Group, at a Lexington Cut Stone quarry in Jessamine County.

Medusa Aggregates purchased the Commonwealth Stone quarry in south central Kentucky. The quarry, located in Warren County, produces about 360,000 metric tons of crushed stone per year (Drake, 1998). Later in the year, Medusa, which has six quarries in the State, was acquired by Southdown, Inc., the owner of Kentucky's sole cement plant, located on the Ohio River near Louisville, and an auxiliary limestone quarry down river in Meade County (Burdette, 1998). In northeastern Kentucky, Mountain Materials purchased a quarry near Carter

[1]The terms "nonfuel mineral production" and related "values" encompass variations in meaning, depending on the minerals or mineral products. Production may be measured by mine shipments, mineral commodity sales, or marketable production (including consumption by producers) as is applicable to the individual mineral commodity.

All 1998 USGS mineral production data published in this chapter are preliminary estimates as of February 1999 and are expected to change. For some mineral commodities (for example, construction sand and gravel, crushed stone, and portland cement), estimates are updated periodically. To obtain the most current information, please contact the appropriate USGS mineral commodity specialist. A telephone listing for the specialists may be retrieved over the Internet at http://minerals.usgs.gov/minerals/contacts/comdir.html; by using MINES FaxBack at (703) 648-4999 from a fax machine with a touch-tone handset (request Document #1000 for a telephone listing of all mineral commodity specialists); or by calling USGS information at (703) 648-4000 for the specialist's name and number. All Mineral Industry Surveys–mineral commodity, State, and country–also may be retrieved over the Internet at http://minerals.usgs.gov/minerals; facsimile copies may be obtained from MINES FaxBack.

[2]Values, percentage calculations, and rankings for 1997 may vary from the *Minerals Yearbook, Area Reports: Domestic 1997, Volume II*, owing to the revision of preliminary 1997 to final 1997 data. Data for 1998 are preliminary and expected to change, while related rankings may also be subject to change.

[3]Garland Dever, Jr., Geologist, submitted the text of information provided by the Kentucky Geological Survey.

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City in northwestern Carter County (Kentucky Crushed Stone Association, 1998c).

Martin Marietta Materials bought a sand and gravel operation near Petersburg in western Boone County, northern Kentucky (Kentucky Crushed Stone Association, 1998b). In western Kentucky, Liter's Quarry, Inc., purchased Davies County Sand & Gravel, a producer with an operation near Owensboro (Kentucky Crushed Stone Association, 1998a).

According to the KGS, Southwire Corp. plans to spend nearly $8 million to add a new aluminum rod mill at its Hancock County plant, which already has two aluminum rod mills. The new mill at Hawesville will make specialty alloys and will enable the other systems to produce standard rods at faster speeds.

Limestone continued to be an exploration target in Kentucky during 1998, mainly for sources of construction aggregate near urban areas. No exploratory drilling was reported in the State's mineral districts.

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TABLE 1
NONFUEL RAW MINERAL PRODUCTION IN KENTUCKY 1/ 2/

(Thousand metric tons and thousand dollars unless otherwise specified)

Mineral	1996		1997		1998 p/	
	Quantity	Value	Quantity	Value	Quantity	Value
Clays:						
Ball	70	W	W	W	W	W
Common	823	3,680	865	3,910	882	3,980
Fire	--	--	7	W	--	--
Gemstones	NA	5,910	NA	3,520	NA	329
Sand and gravel: Construction	7,310	25,600	8,140	26,600	7,870	26,500
Stone: Crushed 3/	58,500	243,000	62,700	292,000	61,300	282,000
Combined values of cement, lime, stone [crushed sandstone (1996-97)], and values indicated by symbol W	XX	164,000	XX	172,000	XX	176,000
Total	XX	442,000	XX	498,000	XX	489,000

p/ Preliminary. NA Not available. W Withheld to avoid disclosing company proprietary data; value included with "Combined values" data.
1/ Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
2/ Data are rounded to three significant digits; may not add to totals shown.
3/ Excludes certain stones; kind and value included with "Combined values" data.

TABLE 2
KENTUCKY: CRUSHED STONE SOLD OR USED BY PRODUCERS, BY KIND 1/

Kind	1996				1997			
	Number of quarries	Quantity (thousand metric tons)	Value (thousands)	Unit value	Number of quarries	Quantity (thousand metric tons)	Value (thousands)	Unit value
Limestone	92	58,500	$243,000	$4.15	91	62,700	$292,000	$4.65
Sandstone	1	(2/)	(2/)	(2/)	1	(2/)	(2/)	(2/)
Total	XX	58,500	243,000	4.15	XX	62,700	292,000	4.65

XX Not applicable.
1/ Data are rounded to three significant digits, except unit value; may not add to totals shown.
2/ Excluded from State total to avoid disclosing company proprietary data.

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TABLE 3

KENTUCKY: CRUSHED STONE SOLD OR USED BY PRODUCERS IN 1997, BY USE 1/ 2/

Use	Quantity (thousand metric tons)	Value (thousands)	Unit value
Coarse aggregate (+1 1/2 inch):			
Riprap and jetty stone	528	$3,310	$6.27
Filter stone	511	2,880	5.64
Other coarse aggregate 3/	405	2,370	5.85
Coarse aggregate, graded:			
Concrete aggregate, coarse	2,400	13,100	5.44
Bituminous aggregate, coarse	3,280	20,200	6.16
Bituminous surface-treatment aggregate	1,530	8,960	5.86
Railroad ballast	247	1,370	5.53
Other graded coarse aggregate	460	2,550	5.54
Fine aggregate (-3/8 inch):			
Stone sand, concrete	133	768	5.77
Stone sand, bituminous mix or seal	1,160	6,100	5.28
Screening, undesignated	783	3,610	4.61
Other fine aggregate	209	919	4.40
Coarse and fine aggregate:			
Graded road base or subbase	3,950	21,700	5.49
Unpaved road surfacing	697	3,480	4.99
Crusher run or fill or waste	894	3,360	3.76
Other construction materials 4/	690	3,760	5.45
Agricultural limestone	511	2,660	5.21
Chemical and metallurgical:			
Cement manufacture	W	W	1.56
Lime manufacture	W	W	1.33
Flux stone	W	W	4.20
Sulfur oxide removal	W	W	13.09
Special:			
Mine dusting or acid water treatment	W	W	13.95
Roofing granules	W	W	5.50
Other specified uses not listed	96	576	6.00
Unspecified: 5/			
Actual	27,400	129,000	4.70
Estimated	12,900	53,400	4.14
Total	62,700	292,000	4.65

W Withheld to avoid disclosing company proprietary data; included in "Total."
1/ Data are rounded to three significant digits, except unit value; may not add to totals shown.
2/ Includes limestone; excludes sandstone from State total to avoid disclosing company proprietary data.
3/ Includes macadam.
4/ Includes waste material and other coarse and fine aggregates.
5/ Reported and estimated production without a breakdown by end use.

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TABLE 4
KENTUCKY: CRUSHED STONE SOLD OR USED BY PRODUCERS IN 1997, BY USE AND DISTRICT 1/ 2/

(Thousand metric tons and thousand dollars)

Use	District 1		District 2		District 3		District 4	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
Construction aggregates:								
Coarse aggregate (+1 1/2 inch) 3/	W	W	211	1,200	618	3,900	514	2,850
Coarse aggregate, graded 4/	W	W	1,550	9,290	3,400	22,000	2,050	10,500
Fine aggregate (-3/8 inch) 5/	W	W	468	3,090	1,010	4,730	525	2,420
Coarse and fine aggregate 6/	W	W	1,110	5,890	2,670	14,800	1,350	6,240
Other construction materials 7/	--	--	--	--	W	W	--	--
Agricultural 8/	W	W	272	1,430	W	W	W	W
Chemical and metallurgical 9/	--	--	--	--	W	W	--	--
Special 10/	--	--	--	--	W	W	--	--
Other miscellaneous uses	--	--	--	--	W	W	--	--
Unspecified: 11/								
Actual	16,200	87,400	3,620	9,010	6,270	27,700	W	W
Estimated	700	3,880	3,730	12,200	4,350	16,600	4,130	20,800
Total	19,300	103,000	11,000	42,100	22,500	99,100	9,960	47,700

W Withheld to avoid disclosing company proprietary data; included in "Total."
1/ Data are rounded to three significant digits; may not add to totals shown.
2/ Excludes sandstone from State total to avoid disclosing company proprietary data.
3/ Includes filter stone, macadam, riprap and jetty stone, and other coarse aggregate.
4/ Includes concrete aggregate (coarse), bituminous aggregate (coarse), bituminous surface-treatment aggregate, railroad ballast, and other graded coarse aggregate.
5/ Includes stone sand (concrete), stone sand (bituminous mix or seal), screening (undesignated), and other fine aggregate.
6/ Includes graded road base or subbase, unpaved road surfacing, crusher run (select material or fill), and other coarse and fine aggregates.
7/ Includes waste material.
8/ Includes agricultural limestone.
9/ Includes cement manufacture, lime manufacture, and sulfur oxide removal.
10/ Includes mine dusting or acid water treatment, and other fillers or extenders.
11/ Reported and estimated production without a breakdown by end use.

TABLE 5
KENTUCKY: CONSTRUCTION SAND AND GRAVEL SOLD OR USED IN 1997,
BY MAJOR USE CATEGORY 1/ 2/

Use	Quantity (thousand metric tons)	Value (thousands)	Value per ton
Concrete aggregate and concrete products (including concrete sand)	3,490	$10,800	$3.09
Asphaltic concrete aggregates and other bituminous mixtures	246	710	2.89
Road base and coverings 3/	92	267	2.90
Fill	329	864	2.63
Snow and ice control	19	93	4.89
Other miscellaneous uses 4/	190	678	3.57
Unspecified: 5/			
Actual	518	1,460	2.81
Estimated	3,260	11,800	3.62
Total or average	8,140	26,600	3.27

1/ To avoid disclosing company proprietary data, no district tables were produced for 1997.
2/ Data are rounded to three significant digits; may not add to totals shown.
3/ Includes road and other stabilization (cement and lime).
4/ Includes filtration.
5/ Reported and estimated production without a breakdown by end use.

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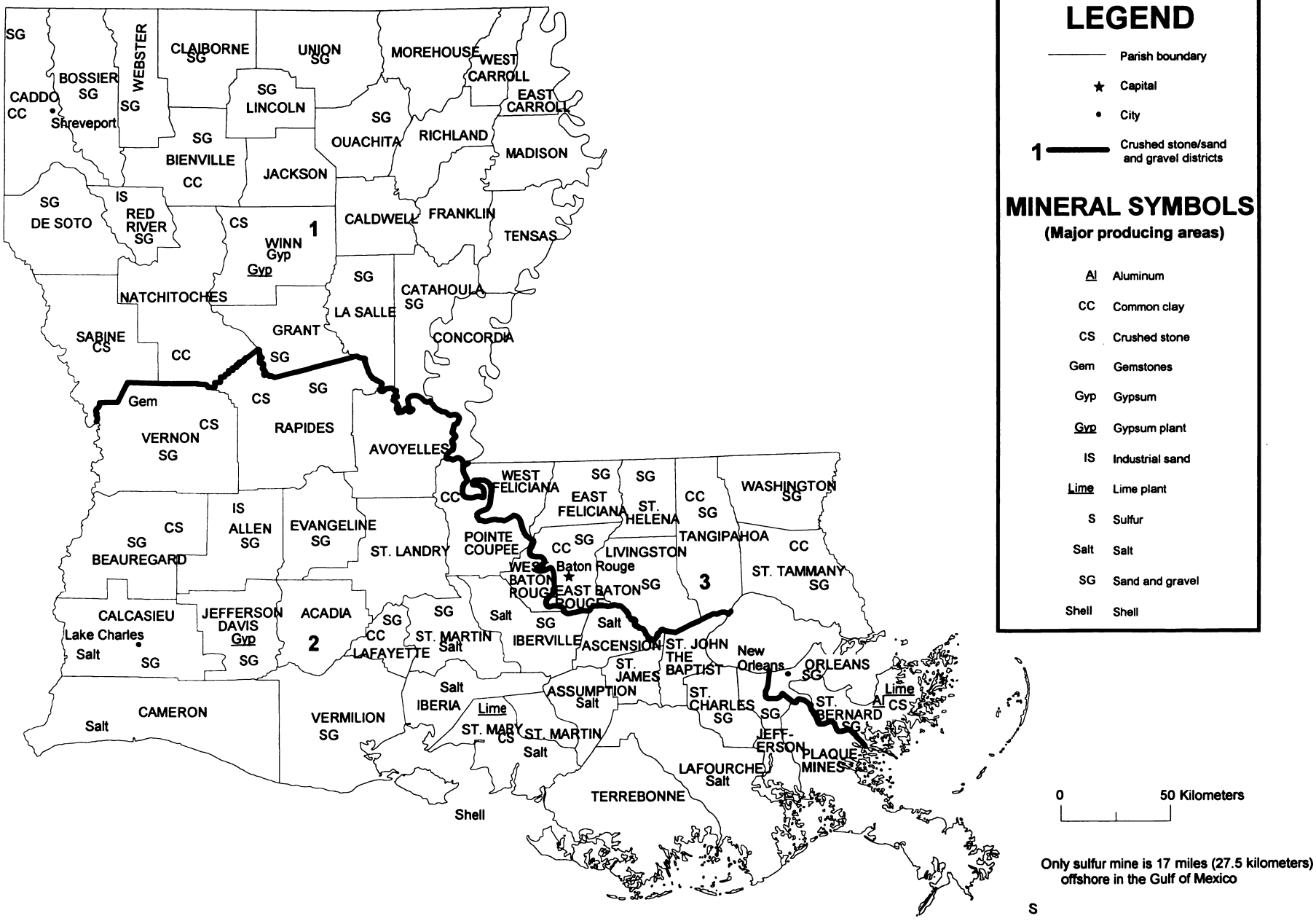
LOUISIANA



LEGEND

- Parish boundary
- ★ Capital
- • City
- 1 — Crushed stone/sand and gravel districts

MINERAL SYMBOLS

(Major producing areas)

Al	Aluminum
CC	Common clay
CS	Crushed stone
Gem	Gemstones
Gyp	Gypsum
Gyp	Gypsum plant
IS	Industrial sand
Lime	Lime plant
S	Sulfur
Salt	Salt
SG	Sand and gravel
Shell	Shell

0 — 50 Kilometers

Only sulfur mine is 17 miles (27.5 kilometers) offshore in the Gulf of Mexico

Source: Louisiana Geological Survey/U.S. Geological Survey (1998)

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THE MINERAL INDUSTRY OF LOUISIANA

This chapter has been prepared under a Memorandum of Understanding between the U.S. Geological Survey and the Louisiana Geological Survey for collecting information on all nonfuel minerals.

In 1998, the preliminary estimated value[1] of nonfuel mineral production for Louisiana was $379 million, according to the U.S. Geological Survey (USGS). This was about a 6% decrease from that of 1997,[2] following a 2.3% increase from 1996 to 1997. The State decreased in rank from 32d to 33d among the 50 States in 1998 in total nonfuel mineral production value, of which Louisiana accounted for about 1% of the U.S. total.

Louisiana's leading nonfuel mineral is salt, accounting for about 45% of the State's nonfuel mineral value in 1998. When included as part of Louisiana's mineral production, sulfur is the State's second-leading mineral commodity. All current sulfur production comes from a mine that is 27 kilometers offshore of Louisiana. Because of the mine's location, the State does not receive severance tax income or mineral production royalties; instead, they are collected by the Federal Government. Consequently, since 1991 the State and the Louisiana Geological Survey (LGS) do not consider the sulfur production cited in table 1 under "Combined value" as being part of Louisiana's nonfuel mineral production. The USGS attributes this offshore sulfur production to Louisiana because it is the State nearest to the sulfur mine and Freeport-McMoRan Sulphur Inc., the company that operates the mine, is based in New Orleans.

In 1998, a significant decrease in the value of Frasch sulfur accounted for most of the State's drop in nonfuel mineral value. International cutbacks and two hurricanes that affected the area caused significant technical problems and led to lower production and a decrease in sulfur value. This decrease was partially mitigated by the increased value of construction sand and gravel (table 1). All other mineral commodity values increased except for crude gypsum and gemstones, which showed small decreases, and industrial sand and gravel, which remained the same.

In 1997, moderate decreases that occurred in the values of construction sand and gravel and salt (descending order of change) were more than balanced by increases in crushed stone (including crushed limestone under "Combined values" in table 1), common clay, lime, and Frasch sulfur.

Based on USGS estimates of the quantities produced in the 50 States during 1998, Louisiana remained the leading[2] State in the Nation in salt and sulfur production.

The LGS provided the following narrative information.[3] On April 4, 1998, following years of controversy, especially related to charges of environmental racism, Louisiana Energy Services (LES), a multinational partnership, dropped its plans to build a uranium enrichment plant, owing to significant delays in the permit application process that prohibitively increased the cost of its licensing process. In 1991, LES applied for a permit to build an $800 million uranium enrichment plant in rural Claiborne parish, which is in the northwestern part of the State, northeast of Shreveport (Shinkle, 1998).

Reference Cited

Shinkle, Peter, 1998, Uranium plant plan dropped: The Advocat, April 23, p. 4A.

[1]The terms "nonfuel mineral production" and related "values" encompass variations in meaning, depending on the minerals or mineral products. Production may be measured by mine shipments, mineral commodity sales, or marketable production (including consumption by producers) as is applicable to the individual mineral commodity.

All 1998 USGS mineral production data published in this chapter are preliminary estimates as of February 1999 and are expected to change. Construction sand and gravel and crushed stone estimates are updated periodically. To obtain the most current information, please contact the appropriate USGS mineral commodity specialist. A telephone listing for the specialists may be retrieved over the Internet at http://minerals.usgs.gov /minerals/contacts/comdir.html; by using MINES FaxBack at (703) 648-4999 from a fax machine with a touch-tone handset (request Document #1000 for a telephone listing of all mineral commodity specialists); or by calling USGS information at (703) 648-4000 for the specialist's name and number. All Mineral Industry Surveys–mineral commodity, State, and country–also may be retrieved over the Internet at http://minerals.usgs.gov/minerals; facsimile copies may be obtained from MINES FaxBack.

[2]Values, percentage calculations, and rankings for 1997 may vary from the *Minerals Yearbook, Area Reports: Domestic 1997, Volume II*, owing to the revision of preliminary 1997 to final 1997 data. Data for 1998 are preliminary and expected to change, while related rankings may also be subject to change.

[3]Syed M. Haque, Research Geologist at the LGS, authored the text of Louisiana minerals industry information submitted by the LGS.

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TABLE 1
NONFUEL RAW MINERAL PRODUCTION IN LOUISIANA 1/ 2/

(Thousand metric tons and thousand dollars unless otherwise specified)

Mineral	1996		1997		1998 p/	
	Quantity	Value	Quantity	Value	Quantity	Value
Clays: Common	382	548	556	9,060	567	9,240
Gemstones	NA	136	NA	15	NA	7
Salt	15,500	175,000	15,300	169,000	15,000	170,000
Sand and gravel:						
Construction	11,500	53,200	10,400	46,600	12,600	58,300
Industrial	706	12,100	644	11,200	644	11,200
Stone: Crushed 3/	2,290	23,900	1,570	16,100	1,600	16,200
Combined values of gypsum (crude), lime, stone [crushed limestone (1997-98), crushed miscellaneous (1996)], sulfur (Frasch)	XX	128,000	XX	150,000	XX	114,000
Total	XX	393,000	XX	402,000	XX	379,000

p/ Preliminary. NA Not available. XX Not applicable.
1/ Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
2/ Data are rounded to three significant digits; may not add to totals shown.
3/ Excludes certain stones; kind and value included with "Combined values" data.

TABLE 2
LOUISIANA: CRUSHED STONE SOLD OR USED, BY KIND 1/

Kind	1996				1997			
	Number of quarries	Quantity (thousand metric tons)	Value (thousands)	Unit value	Number of quarries	Quantity (thousand metric tons)	Value (thousands)	Unit value
Sandstone	13	2,290	$23,900	$10.44	9	1,570	$16,100	$10.30
Limestone	--	--	--	--	4	(2/)	(2/)	(2/)
Total	XX	2,290	23,900	10.44	XX	1,570	16,100	10.30

XX Not applicable.
1/ Data are rounded to three significant digits, except unit value.
2/ Excluded from State total to avoid disclosing company proprietary data.

TABLE 3
LOUISIANA: CRUSHED STONE SOLD OR USED BY PRODUCERS
IN 1997, BY USE 1/ 2/

Use	Quantity (thousand metric tons)	Value (thousands)	Unit value
Coarse aggregate, graded: Bituminous aggregate, coarse	W	W	$1.10
Fine aggregate (-3/8): Stone sand, bituminous mix or seal	W	W	1.06
Unspecified: 3/			
Actual	1,410	15,500	11.05
Estimated	103	537	5.21
Total	1,570	16,100	10.30

W Withheld to avoid disclosing company proprietary data; included in "Total."
1/ Data are rounded to three significant digits, except unit value; may not add to totals shown.
2/ Includes sandstone; excludes limestone from State total to avoid disclosing company proprietary data.
3/ Includes reported and estimated production without a breakdown by end use.

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TABLE 4
LOUISIANA: CRUSHED STONE SOLD OR USED BY PRODUCERS IN 1997,
BY USE AND DISTRICT 1/ 2/
(Thousand metric tons and thousand dollars)

Use	District 1		District 2		District 3		Unspecified districts	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
Construction aggregates:								
Coarse aggregate, graded 3/	--	--	--	--	W	W	--	--
Fine aggregate (-3/8 inch) 4/	--	--	--	--	W	W	--	--
Unspecified: 5/								
Actual	263	2,910	595	6,580	--	--	548	6,060
Estimated	--	--	--	--	103	537	--	--
Total	263	2,910	595	6,580	161	601	548	6,060

W Withheld to avoid disclosing company proprietary data; included in "Total."
1/ Data are rounded to three significant digits; may not add to totals shown.
2/ Excludes limestone from State total to avoid disclosing company proprietary data.
3/ Includes bituminous aggregate (coarse).
4/ Includes stone sand (bituminous mix or seal).
5/ Includes reported and estimated production without a breakdown by end use.

TABLE 5
LOUISIANA: CONSTRUCTION SAND AND GRAVEL SOLD OR USED IN 1997,
BY MAJOR USE CATEGORY 1/ 2/

Use	Quantity (thousand metric	Value (thousands)	Value per ton
Concrete aggregate (including concrete sand) 3/	3,650	$15,400	$4.23
Asphaltic concrete aggregates and other bituminous mixtures	472	2,170	4.59
Road base and coverings 4/	386	2,060	5.33
Other miscellaneous uses 5/	995	3,690	3.71
Unspecified: 6/			
Actual	3,280	16,500	5.03
Estimated	1,580	6,780	4.29
Total or average	10,400	46,600	4.50

1/ To avoid disclosing company proprietary data, no district tables were produced for 1997.
2/ Data are rounded to three significant digits; may not add to totals shown.
3/ Includes plaster and gunite sands, and concrete products.
4/ Includes road and other stabilization (lime).
5/ Includes fill and roofing granules.
6/ Includes reported and estimated production without a breakdown by end use.

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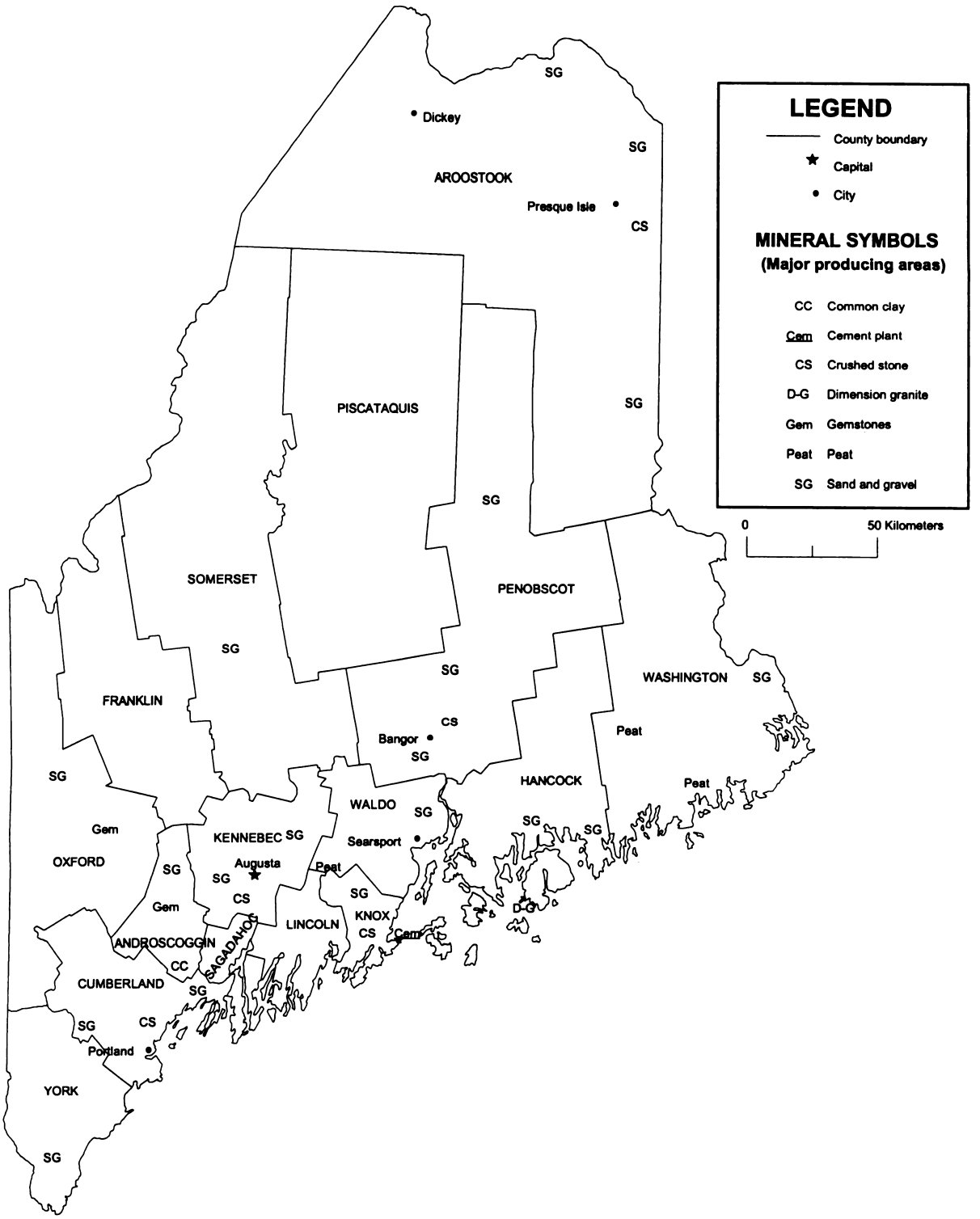
MAINE



Source: Maine Geological Survey/U.S. Geological Survey (1998)

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THE MINERAL INDUSTRY OF MAINE

This chapter has been prepared under a Memorandum of Understanding between the U.S. Geological Survey and the Maine Geological Survey for collecting information on all nonfuel minerals.

In 1998, the preliminary estimated value[1] of nonfuel mineral production for Maine was $76.2 million, according to the U.S. Geological Survey (USGS). This was almost a 9% increase from that of 1997,[2] and followed a 2.3% increase in 1997 from that of 1996. Maine's increase in value in 1998 mostly resulted from increases in the values of construction sand and gravel, crushed stone (table 1), and portland cement that totaled almost $7.5 million. (Listing of minerals is in descending order of change in value.) Peat showed a small, yet significant decrease and gemstones decreased marginally; all other minerals had small increases. In 1997, the mineral commodities mostly responsible for the State's increase were peat and construction sand and gravel.

Based on USGS estimates of the quantities of peat produced in the United States, Maine was 11th[2] in peat in 1998. Previously, the State had risen to 3d in 1997 after being 7th in 1996.

The Maine Geological Survey (MGS) provided the following narrative information.[3] Freewest Resources Canada Inc., continued a grass roots gold exploration program along the Maine-New Brunswick, Canada, border on its "Golden Ridge Property." The gold occurrence was indicated initially by anomalous gold values in a regional till sampling project by the Province of New Brunswick in 1992 and refined through followup sampling. Detailed airborne and ground geophysical surveys by Freewest show strong magnetic and induced polarization anomalies over the Ordovician Poplar Mountain volcanic-plutonic complex near Fosterville, New Brunswick, and over the adjacent area in Amity, ME. Detailed soil sampling has shown anomalous values for arsenic, antimony, and gold over the geophysical anomalies. Rock grab samples returned assay values up to 8.1 grams per metric ton gold (Northern Miner, 1998). Bedrock geology on the Maine side has not been mapped in detail due to poor outcrop, but includes mineralized felsic pyroclastic rocks and altered basalts. Some float blocks include massive sulfide clasts. Outcrop stripping and trenching were done on the New Brunswick claim late in 1998. Exploratory drilling is planned for 1999. The Maine property is owned by Champion International Corp., which has a lease agreement with Freewest (Freewest Resources Canada Inc., 1998).

At the close of 1997, NNM Resources, Inc., a wholly owned subsidiary of Black Hawk Mining Inc., submitted a permit application to open a gold and silver mine about 24 kilometers west of Ashland at the Bald Mountain deposit in the T12 R8 section (an unorganized township) of Aroostook County. The application is for surface mining of just the gossan cap, which was estimated at the time of application at 1.1 million metric tons of 4.5 grams per ton gold and 101 grams per ton silver. It overlies the 32-million-ton base metal sulfide deposit (zinc, copper, gold, and silver). The application was reviewed by the Maine Land Use Regulation Commission and the Maine Department of Environmental Protection, with comments and questions returned to the applicant in March. At the end of 1998, due to low gold prices, Black Hawk requested and was granted an extension of the application review period to January 2000. The application remains in the permit review process.

At Alder Pond, a 1.5-million to 3-million-ton copper-zinc-lead deposit in Somerset County, northwestern Maine, Prospectors Alliance Ltd. completed a stepout drilling program early in 1998. The property is owned by GCO Minerals Co. The recent drilling was done by Prospectors Alliance Corporation of Toronto in joint venture with International Larder Minerals, Inc. At the end of 1998, the exploration permit was allowed to expire.

Geologists from the USGS continued study of the Bald Mountain deposit of northern Maine to characterize its mineralization and geologic setting. Stratigraphic, structural, mineralogical, and geochemical aspects all indicate that the deposit is a well-preserved submarine volcanogenic massive sulfide deposit, with both exhalative and subseafloor hydrothermal deposits (Slack and others, 1998; Busby and others, 1998). Regional tectonic and exploration models will need revision because of an unexpected finding. Bald Mountain volcanics are chemically similar to primitive ocean-arc volcanic rocks and not to back-arc basin rocks as had been inferred from nearby areas (Schulz and Ayuso, 1998).

Through a cooperative program with the USGS, MGS has initiated a project to compile a geographically referenced data base of known occurrences, prospects, and mines of economic minerals in the State. The data base, being compiled by a contractor, will draw from a variety of published and unpublished information and will be available to the public. Most localities will not be verified in the field.

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[1]The terms "nonfuel mineral production" and related "values" encompass variations in meaning, depending on the minerals or mineral products. Production may be measured by mine shipments, mineral commodity sales, or marketable production (including consumption by producers) as is applicable to the individual mineral commodity.

All 1998 USGS mineral production data published in this chapter are preliminary estimates as of February 1999 and are expected to change. For some mineral commodities (for example, construction sand and gravel, crushed stone, and portland cement), estimates are updated periodically. To obtain the most current information, please contact the appropriate USGS mineral commodity specialist. A telephone listing for the specialists may be retrieved over the Internet at http://minerals.usgs.gov/minerals/contacts/comdir.html; by using MINES FaxBack at (703) 648-4999 from a fax machine with a touch-tone handset (request Document #1000 for a telephone listing of all mineral commodity specialists); or by calling USGS information at (703) 648-4000 for the specialist's name and number. All Mineral Industry Surveys—mineral commodity, State, and country—also may be retrieved over the Internet at http://minerals.usgs.gov/minerals; facsimile copies may be obtained from MINES FaxBack.

[2]Values, percentage calculations, and rankings for 1997 may vary from the *Minerals Yearbook, Area Reports: Domestic 1997, Volume II*, owing to the revision of preliminary 1997 to final 1997 data. Data for 1998 are preliminary and expected to change, while related rankings may also be subject to change.

[3]Henry N. Berry IV, Physical Geologist, authored the text on mineral industry information submitted by the Maine Geological Survey.

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Amateur and professional mineral collectors continued to work in Maine. Numerous Maine pegmatites, including the Berry, Tamminen, and Georgetown quarries were prospected for tourmaline and other minerals. Rare phosphate species continue to be found in pegmatite at the Estes crushed-rock quarry in West Baldwin. Over 30 minerals have been identified from this quarry to date. The MGS published the third edition of the *Collector's Guide to Maine Mineral Localities*. The 1998 Maine Mineral Symposium in Augusta attracted over 300 participants.

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TABLE 1
NONFUEL RAW MINERAL PRODUCTION IN MAINE 1/ 2/

(Thousand metric tons and thousand dollars unless otherwise specified)

Mineral	1996		1997		1998 p/	
	Quantity	Value	Quantity	Value	Quantity	Value
Gemstones	NA	223	NA	230	NA	227
Peat	18	960	W	W	W	W
Sand and gravel: Construction	6,440	27,500	6,280	28,400	7,100	33,100
Stone: Crushed	2,760	14,800	2,540	15,100	2,800	16,800
Combined values of cement, clays (common), stone (dimension granite), and values indicated by symbol W	XX	25,000	XX	26,500	XX	26,000
Total	XX	68,600	XX	70,200	XX	76,200

p/ Preliminary. NA Not available. W Withheld to avoid disclosing company proprietary data; value included with "Combined values" data. XX Not applicable.
1/ Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
2/ Data are rounded to three significant digits; may not add to totals shown.

TABLE 2
MAINE: CRUSHED STONE SOLD OR USED, BY KIND 1/

Kind	1996				1997			
	Number of quarries	Quantity (thousand metric tons)	Value (thousands)	Unit value	Number of quarries	Quantity (thousand metric tons)	Value (thousands)	Unit value
Limestone	5 r/	1,230 r/	$6,480 r/	$5.28 r/	5	1,030	$6,400	$6.24
Granite	3	W	W	5.04	3	W	W	5.71
Quartzite	2 r/	W	W	5.46 r/	2	W	W	5.65
Slate	2	W	W	7.11	2	W	W	7.28
Traprock	2	W	W	5.77	2	W	W	5.50
Miscellaneous stone	1	W	W	3.98	5	W	W	4.06
Total	XX	2,760	14,800	5.38	XX	2,540	15,100	5.93

r/ Revised. W Withheld to avoid disclosing company proprietary data; included in "Total." XX Not applicable.
1/ Data are rounded to three significant digits; may not add to totals shown.

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TABLE 3
MAINE: CRUSHED STONE SOLD OR USED BY PRODUCERS
IN 1997, BY END USE 1/ 2/

Use	Quantity (thousand metric tons)	Value (thousands)	Unit value
Coarse aggregate (+1 1/2 inch): Other coarse aggregate 3/	59	$370	$6.27
Coarse aggregate, graded: Other coarse aggregate 4/	268	1,480	5.53
Fine aggregate (-3/8 inch): Other fine aggregate 5/	166	1,110	6.66
Coarse and fine aggregate: Other construction materials 6/	282	1,840	6.52
Chemical and metallurgical:			
Cement manufacture	W	W	5.51
Lime manufacture	W	W	5.64
Unspecified: 7/			
Actual	695	4,100	5.89
Estimated	551	3,300	5.99
Total	2,540	15,100	5.93

W Withheld to avoid disclosing company proprietary data; included in "Total."
1/ Data are rounded to three significant digits; may not add to totals shown.
2/ Includes granite, limestone, miscellaneous stone, quartzite, slate, and traprock.
3/ Includes filter stone and riprap and jetty stone.
4/ Includes bituminous aggregate (coarse) and railroad ballast.
5/ Includes stone sand (concrete) and screening (undesignated).
6/ Includes graded road base or subbase and other coarse and fine aggregates.
7/ Includes reported and estimated production without a breakdown by end use.

TABLE 4
MAINE: CRUSHED STONE SOLD OR USED BY PRODUCERS
IN 1997, BY USE AND DISTRICT 1/

(Thousand metric tons and thousand dollars)

Use	District 1	
	Quantity	Value
Construction aggregates:		
Coarse aggregate (+1 1/2 inch) 2/	W	W
Coarse aggregate, graded 3/	W	W
Fine aggregate (-3/8 inch) 4/	W	W
Coarse and fine aggregate 5/	W	W
Other construction materials	774	4,800
Chemical and metallurgical 6/	(7/)	(7/)
Unspecified: 8/		
Actual	(7/)	(7/)
Estimated	(7/)	(7/)
Total	2,540	15,100

W Withheld to avoid disclosing company proprietary data; included with "Other construction materials."
1/ Data are rounded to three significant digits; may not add to totals shown.
2/ Includes filter stone, riprap and jetty stone, and other coarse aggregate.
3/ Includes bituminous aggregate (coarse) and railroad ballast.
4/ Includes stone sand (concrete), screening (undesignated), and other fine aggregate.
5/ Includes graded road base or subbase, unpaved road surfacing, crusher run (select material or fill), and other coarse and fine aggregates.
6/ Includes cement manufacture and lime manufacture.
7/ Withheld to avoid disclosing company proprietary data; included in "Total."
8/ Includes reported and estimated production without a breakdown by end use.

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TABLE 5
MAINE: CONSTRUCTION SAND AND GRAVEL SOLD OR USED IN 1997,
BY MAJOR USE CATEGORY 1/ 2/

Use	Quantity (thousand metric tons)	Value (thousands)	Value per ton
Concrete aggregate (including concrete sand) 3/	661	$3,290	$4.97
Asphaltic concrete aggregates and other bituminous mixtures	886	6,930	7.83
Road base and coverings 4/	1,410	4,840	3.45
Fill	674	1,720	2.55
Snow and ice control	777	2,500	3.22
Filtration	5	41	8.20
Other miscellaneous uses 5/	202	847	4.19
Unspecified: 6/			
Actual	645	3,900	6.04
Estimated	1,030	4,360	4.25
Total or average	6,280	28,400	4.53

1/ To avoid disclosing company proprietary data, no district tables were produced for 1997.
2/ Data are rounded to three significant digits; may not add to totals shown.
3/ Includes concrete products.
4/ Includes road and other stabilization (cement and lime).
5/ Includes railroad ballast.
6/ Includes reported and estimated production without a breakdown by end use.

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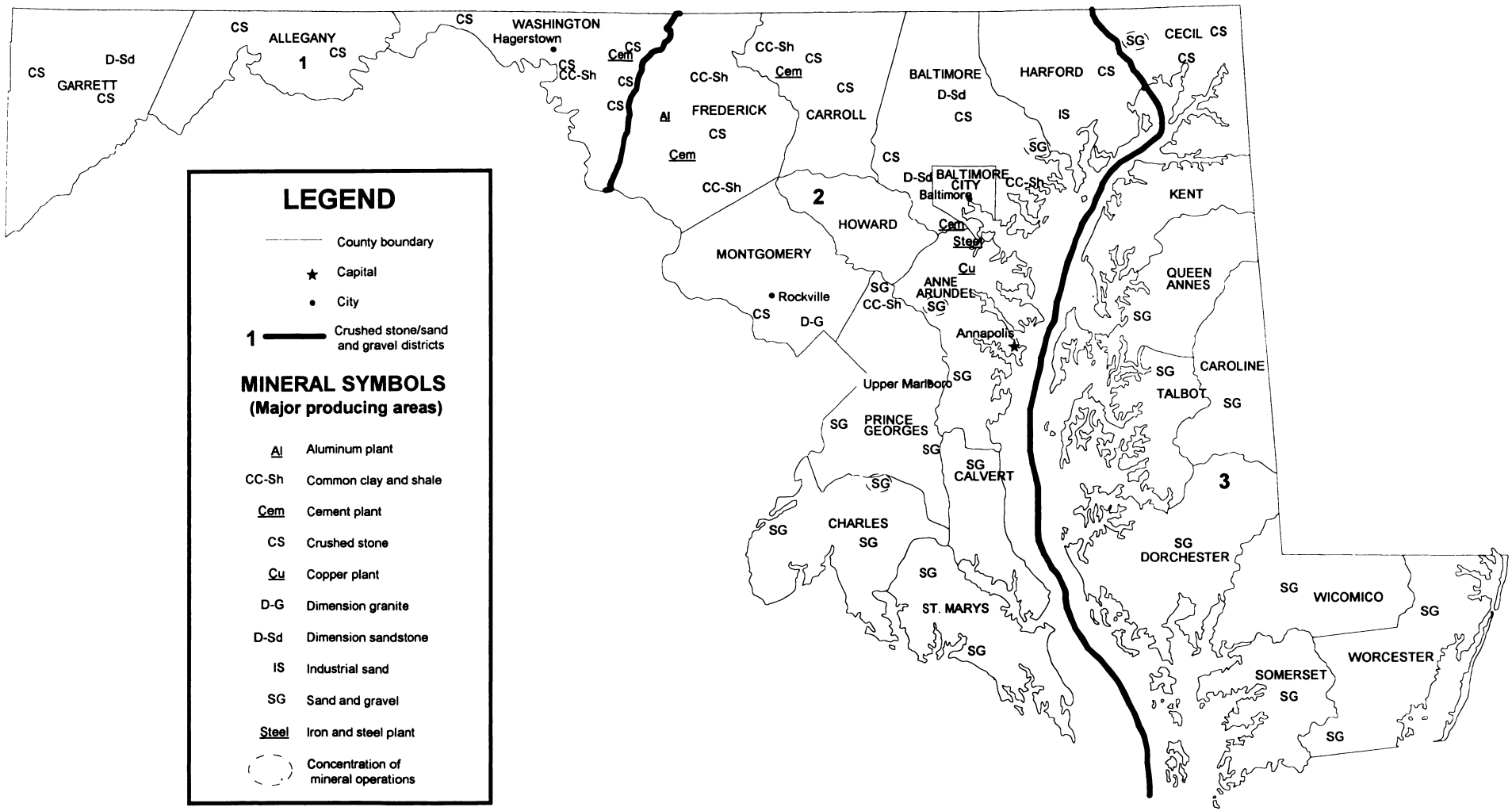
MARYLAND



Source: Maryland Department of the Environment/U.S. Geological Survey (1998)

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THE MINERAL INDUSTRY OF MARYLAND

This chapter has been prepared under a Memorandum of Understanding between the U.S. Geological Survey and the Maryland Department of the Environment, Minerals, Oil, and Gas Division for collecting information on all nonfuel minerals.

In 1998, the preliminary estimated value[1] of nonfuel mineral production for Maryland was $358 million, according to the U.S. Geological Survey (USGS). This was about a 3% decrease from that of 1997,[2] following an 11.8% increase from 1996 to 1997. The State remained 34th among the 50 States in 1998 in total nonfuel mineral production value, of which Maryland accounted for about 1% of the U.S. total.

By value, crushed stone continued as Maryland's leading nonfuel mineral, followed by portland cement and construction sand and gravel. Whereas nearly all nonfuel minerals increased in value in 1998, crushed stone and industrial sand and gravel dropped in value and gemstones remained the same. This emulated 1997 trends, except that the value of crushed stone then had increased by almost 13%.

All nonfuel minerals mined in Maryland were industrial minerals; the State continued to produce substantial quantities of crushed stone, construction sand and gravel, dimension stone, and portland and masonry cement. All metals production, in particular primary aluminum and raw steel, was processed from materials received from foreign and other domestic sources.

The Maryland Department of the Environment (MDE) provided the following narrative information.[3] The MDE has approved a closeout plan for the Arundel Corp.'s Greenspring Quarry in Baltimore County. Extraction activities are scheduled to cease on December 31, 1999, based on agreements made by the company with surrounding residential communities. The reclamation plan is divided into three phases. The quarry first will be filled with water, after which the surrounding area and then the remainder of the property will be graded to facilitate development. In the final phase, development, consisting of residential and commercial buildings, will take place.

In conjunction with the Maryland State Department of Education and the coal and noncoal mineral industries, the MDE is working to put together teaching segments for high school teachers regarding minerals, mining, and reclamation. The segments will satisfy both science and social studies criteria. A team of teachers, MDE, Maryland State Department of Education, and industry representatives will work together in the summer of 1999 to complete the segments, which will be "field tested" by the teachers on the team during the 1999-2000 school year. If the segments are successful, a yearly conference will be started to provide up-to-date information and related teaching aids to teachers across the State.

Additionally, the MDE is working in conjunction with the aggregates industry to produce a video entitled "Environmentally Sound Practices in the Aggregates Industry." The video will be used to teach mining company employees the importance of sound mining and reclamation practices (including all required permits) and projecting a positive image.

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[1]The terms "nonfuel mineral production" and related "values" encompass variations in meaning, depending on the minerals or mineral products. Production may be measured by mine shipments, mineral commodity sales, or marketable production (including consumption by producers) as is applicable to the individual mineral commodity.

All 1998 USGS mineral production data published in this chapter are preliminary estimates as of February 1999 and are expected to change. For some commodities (for example, construction sand and gravel, crushed stone, and portland cement), estimates are updated periodically. To obtain the most current information, please contact the appropriate USGS mineral commodity specialist. A telephone listing for the specialists may be retrieved over the Internet at http://minerals.usgs.gov/minerals/contacts/comdir.html; by using MINES FaxBack at (703) 648-4999 from a fax machine with a touch-tone handset (request Document #1000 for a telephone listing of all mineral commodity specialists); or by calling USGS information at (703) 648-4000 for the specialist's name and number. All Mineral Industry Surveys–mineral commodity, State, and country–also may be retrieved over the Internet at http://minerals.usgs.gov/minerals or by way of MINES FaxBack.

[2]Values, percentage calculations, and rankings for 1997 may vary from the *Minerals Yearbook, Area Reports: Domestic 1997, Volume II*, owing to the revision of preliminary 1997 to final 1997 data. Data for 1998 are preliminary and expected to change, while related rankings may also be subject to change.

[3]C. Edmond Larrimore, Chief, Minerals, Oil and Gas Division, authored the narrative information that was submitted by the Maryland Department of the Environment.

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TABLE 1
NONFUEL RAW MINERAL PRODUCTION IN MARYLAND 1/ 2/

(Thousand metric tons and thousand dollars unless otherwise specified)

Mineral	1996		1997		1998 p/	
	Quantity	Value	Quantity	Value	Quantity	Value
Cement: Portland	1,610	99,400 e/	1,790	115,000 e/	1,850	121,000
Clays: Common	304	874	287	1,010	292	1,030
Gemstones	NA	1	NA	1	NA	1
Sand and gravel: Construction	9,700	61,400	10,100	65,400	11,700	78,200
Stone:						
Crushed 3/	22,400	142,000	24,500	160,000	21,000	126,000
Dimension metric tons	19,800	2,210	21,500	2,440	21,400	2,480
Combined values of cement (masonry), sand and gravel (industrial), stone (crushed marble and traprock)	XX	26,000	XX	28,200	XX	29,000
Total	XX	332,000	XX	371,000	XX	358,000

e/ Estimated. p/ Preliminary. NA Not available. XX Not applicable.
1/ Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
2/ Data are rounded to three significant digits; may not add to totals shown.
3/ Excludes certain stones; kind and value included with "Combined values" data.

TABLE 2
MARYLAND: CRUSHED STONE SOLD OR USED, BY KIND 1/

Kind	1996				1997			
	Number of quarries	Quantity (thousand metric tons)	Value (thousands)	Unit value	Number of quarries	Quantity (thousand metric tons)	Value (thousands)	Unit value
Limestone	21	17,400	$111,000	$6.42	19	18,300	$122,000	$6.67
Granite	3	4,880	29,500	6.04	3	6,020	36,100	6.00
Traprock	1	(2/)	(2/)	(2/)	1	(2/)	(2/)	(2/)
Marble	1	(2/)	(2/)	(2/)	1	(2/)	(2/)	(2/)
Shell	--	--	--	--	1	(2/)	(2/)	(2/)
Sandstone	3	196	1,110	5.64	3	172	1,580	9.16
Total	XX	22,400	142,000	6.33	XX	24,500	160,000	6.52

XX Not applicable.
1/ Data are rounded to three significant digits; may not add to totals shown.
2/ Excluded from State total to avoid disclosing company proprietary data.

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TABLE 3
MARYLAND: CRUSHED STONE SOLD OR USED BY PRODUCERS IN 1997, BY USE 1/ 2/

Use	Quantity (thousand metric tons)	Value (thousands)	Unit value
Coarse aggregate (+1 1/2 inch):			
Riprap and jetty stone	441	$3,530	$8.00
Other coarse aggregate	195	1,340	6.87
Coarse aggregate, graded:			
Concrete aggregate, coarse	999	7,350	7.36
Bituminous aggregate, coarse	1,020	6,910	6.75
Bituminous surface-treatment aggregate	266	2,020	7.58
Other graded coarse aggregate 3/	5,740	40,900	7.12
Fine aggregate (-3/8 inch):			
Stone sand, concrete	450	3,930	8.74
Other fine aggregate 4/	1,310	8,230	6.30
Coarse and fine aggregates:			
Graded road base or subbase	1,760	11,900	6.73
Crusher run or fill or waste	763	4,140	5.42
Other coarse and fine aggregates 5/	766	3,450	4.51
Agricultural: Agricultural limestone	W	W	7.45
Chemical and metallurgical: Cement manufacture	2,660	6,080	2.28
S ecial: g			
Whiting or whiting substitute	W	W	W
Other fillers or extenders	W	W	33.33
Roofing granules	W	W	31.25
Unspecified: Actual: 6/	7,860	40,100	5.10
Total	24,500	160,000	6.52

W Withheld to avoid disclosing company proprietary data; included in "Total."
1/ Data are rounded to three significant digits, except unit value; may not add to totals shown.
2/ Includes granite, limestone, and sandstone; excludes marble, shell, and traprock from State total to disclosing company proprietary data.
3/ Includes railroad ballast.
4/ Stone sand (bituminous mix or seal) and screening (undesignated).
5/ Includes unpaved road surfacing.
6/ Includes actual production without a breakdown by end use.

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TABLE 4
MARYLAND: CRUSHED STONE SOLD OR USED BY PRODUCERS IN 1997,
BY USE AND DISTRICT 1/ 2/

(Thousand metric tons and thousand dollars)

Use	District 1		District 2		District 3	
	Quantity	Value	Quantity	Value	Quantity	Value
Construction aggregates:						
Coarse aggregate (+1 1/2 inch) 3/	W	W	W	W	W	W
Coarse aggregate, graded 4/	W	W	W	W	W	W
Fine aggregate (-3/8 inch) 5/	W	W	W	W	W	W
Coarse and fine aggregate 6/	1,270	6,610	W	W	W	W
Agricultural 7/	W	W	W	W	W	W
Chemical and metallurgical 8/	W	W	W	W	--	--
Special 9/	--	--	W	W	--	--
Other miscellaneous use	--	--	--	--	W	W
Unspecified: Actual 10/	W	W	W	W	--	--
Total	3,650	16,700	18,200	125,000	2,680	18,400

W Withheld to avoid disclosing company proprietary data; included in "Total."
1/ Data are rounded to three significant digits; may not add to totals shown.
2/ Includes granite, limestone and sandstone; excludes marble, traprock, and shell from State total to avoid disclosing proprietary data.
3/ Includes riprap and jetty stone.
4/ Includes concrete aggregate (coarse), bituminous aggregate (coarse), bituminous surface-treatment aggregate, railroad and other graded coarse aggregate.
5/ Includes stone sand (concrete), stone sand (bituminous mix or seal), screening (undesignated), and other fine aggregate.
6/ Includes graded road base or subbase, crusher run (select material or fill), unpaved road surfacing, other coarse and fine aggregates, roofing granules, and waste material.
7/ Includes agricultural limestone and other agricultural uses.
8/ Includes cement manufacture.
9/ Includes other special uses.
10/ Includes reported and estimated production without a breakdown by end use.

TABLE 5
MARYLAND: CONSTRUCTION SAND AND GRAVEL SOLD OR USED IN 1997,
BY MAJOR USE CATEGORY 1/ 2/

Use	Quantity (thousand metric tons)	Value (thousands)	Value per ton
Concrete aggregate (including concrete sand) 3/	4,030	$28,100	$6.98
Concrete products (blocks, bricks, pipe, decorative, etc.)	4	23	5.75
Asphaltic concrete aggregates and other bituminous mixtures	367	2,830	7.70
Road base and coverings 4/	236	1,360	5.78
Fill	173	349	2.02
Other miscellaneous uses 5/	180	1,130	6.25
Unspecified: 6/			
Actual	2,680	19,300	7.23
Estimated	2,400	12,300	5.12
Total or average	10,100	65,400	6.50

1/ To avoid disclosing company proprietary data, no district tables were produced for 1997.
2/ Data are rounded to three significant digits; may not add to totals shown.
3/ Includes plaster and gunite sands.
4/ Includes road stabilization (lime).
5/ Includes filtration, railroad ballast, and snow and ice control.
6/ Includes reported and estimated production without a breakdown by end use.

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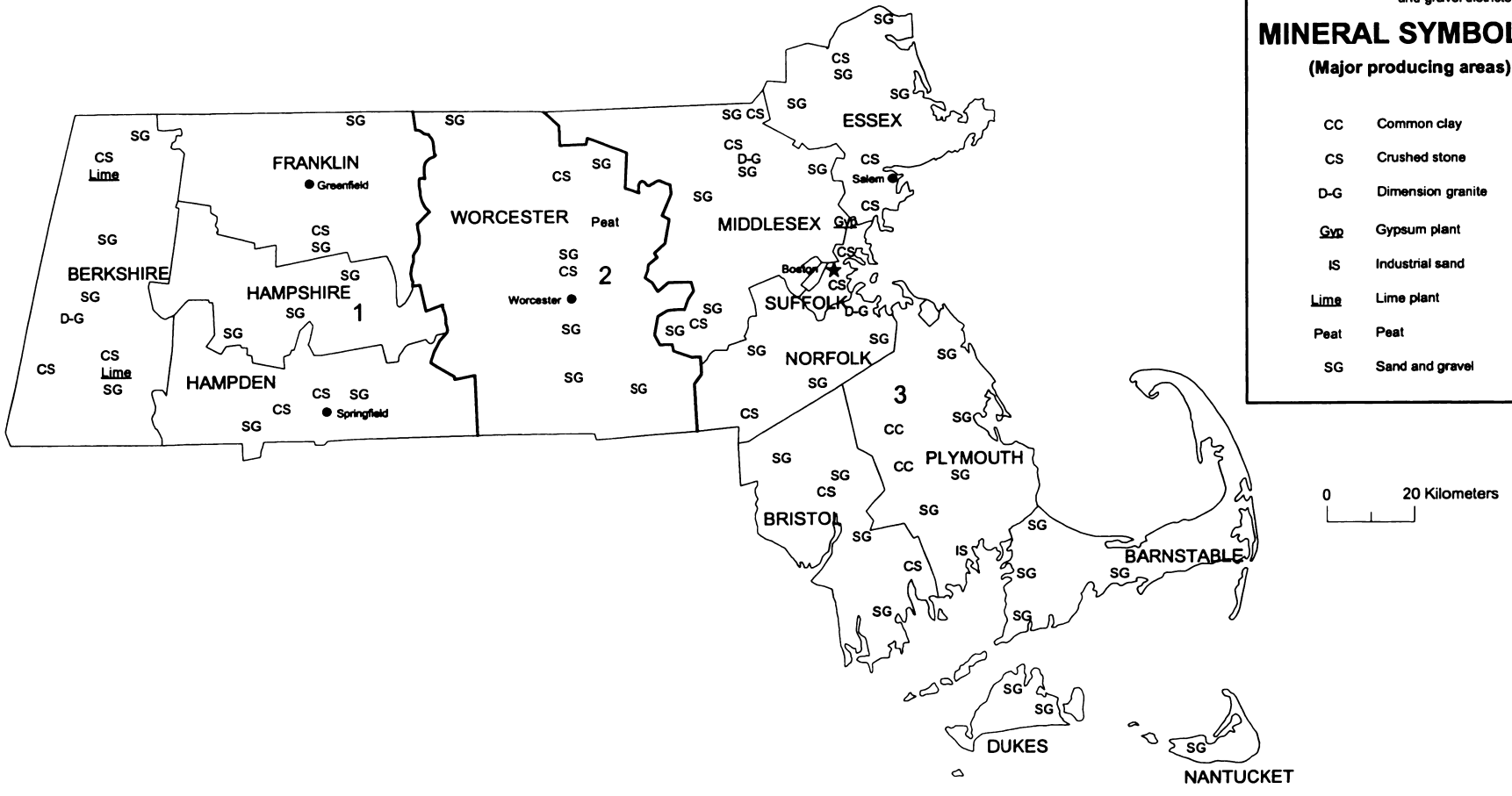
MASSACHUSETTS



Source: Massachusetts Executive Office of Environmental Affairs/U.S. Geological Survey (1998)

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THE MINERAL INDUSTRY OF MASSACHUSETTS

This chapter has been prepared under a Memorandum of Understanding between the U.S. Geological Survey and the Massachusetts Executive Office of Environmental Affairs for collecting information on all nonfuel minerals.

In 1998, the preliminary estimated value[1] of nonfuel mineral production for Massachusetts was $192 million, according to the U.S. Geological Survey (USGS). This was a marginal decrease from that of 1997,[2] following a 3.5% decrease from 1996 to 1997. The leading mineral commodities by value were crushed stone, construction sand and gravel, and dimension stone. (All mineral commodity listings are by descending order of value or magnitude of change in value.) In 1998, the largest changes included a more than $5 million increase in construction sand and gravel that was slightly less than the decrease in dimension stone; all other changes were relatively small (table 1). Crushed stone, common clay, and lime showed small, while miscellaneous crushed stone and peat decreased. Gemstones and industrial sand and gravel remained the same. In 1997, a decrease in the value of construction sand and gravel accounted for most of the State's overall decrease that was moderated somewhat by an increase in the value of crushed stone. Based on USGS estimates of the quantities of dimension stone produced in the United States in 1998, Massachusetts decreased from third to sixth.[2]

[1]The terms "nonfuel mineral production" and related "values" encompass variations in meaning, depending on the minerals or mineral products. Production may be measured by mine shipments, mineral commodity sales, or marketable production (including consumption by producers) as is applicable to the individual mineral commodity.

All 1998 USGS mineral production data published in this chapter are preliminary estimates as of February 1999 and are expected to change. Construction sand and gravel and crushed stone estimates are updated periodically. To obtain the most current information, please contact the appropriate USGS mineral commodity specialist. A telephone listing for the specialists may be retrieved over the Internet at http://minerals.usgs.gov/minerals/contacts/comdir.html; by using MINES FaxBack at (703) 648-4999 from a fax machine with a touch-tone handset (request Document #1000 for a telephone listing of all mineral commodity specialists); or by calling USGS information at (703) 648-4000 for the specialist's name and number. All Mineral Industry Surveys—mineral commodity, State, and country—also may be retrieved over the Internet at http://minerals.usgs.gov/minerals; facsimile copies may be obtained from MINES FaxBack.

[2]Values, percentage calculations, and rankings for 1997 may vary from the *Minerals Yearbook, Area Reports: Domestic 1997, Volume II*, owing to the revision of preliminary 1997 to final 1997 data. Data for 1998 are preliminary and expected to change, while related rankings may also be subject to change.

TABLE 1
NONFUEL RAW MINERAL PRODUCTION IN MASSACHUSETTS 1/ 2/

(Thousand metric tons and thousand dollars unless otherwise specified)

Mineral	1996		1997		1998 p/	
	Quantity	Value	Quantity	Value	Quantity	Value
Gemstones	NA	1	NA	1	NA	1
Sand and gravel: Construction	14,200	82,500	13,500	71,500	14,000	76,600
Stone:						
Crushed	11,800 3/	91,600 3/	12,200 3/	91,300 3/	13,100	91,700
Dimension metric tons	79,600	15,000	101,000	18,200	73,900	12,800
Combined values of clays (common), lime, peat (1996-97), sand and gravel (industrial), stone miscellaneous (1996-97)], and values indicated by symbol W	XX	11,100	XX	11,700	XX	11,100
Total	XX	200,000	XX	193,000	XX	192,000

p/ Preliminary. NA Not available. XX Not applicable.
1/ Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
2/ Data are rounded to three significant digits; may not add to totals shown.
3/ Excludes certain stones; kind and value included with "Combined values" data.

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TABLE 2
MASSACHUSETTS: CRUSHED STONE SOLD OR USED, BY KIND 1/

Kind	1996 Number of quarries	1996 Quantity (thousand metric tons)	1996 Value (thousands)	1996 Unit value	1997 Number of quarries	1997 Quantity (thousand metric tons)	1997 Value (thousands)	1997 Unit value
Limestone 2/	6	2,140	$23,500	$10.97	7	2,050	$22,200	$10.83
Granite	10 r/	3,600 r/	27,100 r/	7.53	9	3,190	20,000	6.27
Traprock	18 r/	6,050 r/	41,000 r/	6.78 r/	17	7,000	49,100	7.02
Miscellaneous stone	1	(3/)	(3/)	(3/)	1	(3/)	(3/)	(3/)
Total	XX	11,800	91,600	7.77	XX	12,200	91,300	7.46

r/ Revised. XX Not applicable.
1/ Data are rounded to three significant digits, except unit value; may not add to totals shown.
2/ Includes "limestone-dolomite," reported with no distinction between the two.
3/ Excluded from State total to avoid disclosing company proprietary data.

TABLE 3
MASSACHUSETTS: CRUSHED STONE SOLD OR USED
BY PRODUCERS IN 1997, BY USE 1/ 2/

Use	Quantity (thousand metric tons)	Value (thousands)	Unit value
Coarse aggregate (+1 1/2 inch):			
Riprap and jetty stone	27	$198	$7.33
Filter stone	219	1,610	7.35
Other coarse aggregate 3/	93	879	9.45
Coarse aggregate, graded:			
Concrete aggregate, coarse	637	4,650	7.30
Bituminous aggregate, coarse	4,080	24,900	6.11
Railroad ballast	508	3,690	7.27
Other graded coarse aggregate 4/	552	4,210	7.62
Fine aggregate (-3/8 inch):			
Stone sand, concrete	221	1,420	6.43
Other fine aggregate 5/	909	5,330	5.86
Coarse and fine aggregates:			
Graded road base or subbase	380	2,590	6.81
Crusher run or fill or waste	405	2,130	5.27
Unpaved road surfacing	181	1,070	5.93
Other coarse and fine aggregates	127	1,010	7.92
Special: Roofing granules	W	W	10.34
Unspecified: 6/			
Actual	W	W	9.11
Estimated	3,830	36,900	9.63
Total	12,200	91,300	7.46

W Withheld to avoid disclosing company proprietary data; included in "Total."
1/ Data are rounded to three significant digits, except unit value; may not add to totals shown.
2/ Includes dolomite, granite, limestone, limestone-dolomite, and traprock; excludes stone.
3/ Includes macadam.
4/ Includes bituminous surface-treatment aggregate.
5/ Includes stone sand (bituminous mix or seal) and screening (undesignated).
6/ Includes reported and estimated production without a breakdown by end use.

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TABLE 4
MASSACHUSETTS: CRUSHED STONE SOLD OR USED BY PRODUCERS IN 1997,
BY USE AND DISTRICT 1/

(Thousand metric tons and thousand dollars)

Use	District 1		District 2		District 3	
	Quantity	Value	Quantity	Value	Quantity	Value
Construction aggregates:						
Coarse aggregate (+1 1/2 inch) 2/	--	--	W	W	W	W
Coarse aggregate, graded 3/	W	W	W	W	3,530	24,200
Fine aggregate (-3/8 inch) 4/	W	W	205	1,280	618	3,440
Coarse and fine aggregate 5/	W	W	484	2,790	341	2,440
Unspecified: 6/						
Actual	--	--	--	--	W	W
Estimated	2,020	21,800	W	W	1,100	8,840
Total	3,850	33,700	2,520	16,500	5,870	41,100

W Withheld to avoid disclosing company proprietary data; included in "Total."
1/ Data are rounded to three significant digits; may not add to totals shown.
2/ Includes filter stone, macadam, riprap and jetty stone, and other coarse aggregate.
3/ Includes concrete aggregate (coarse), bituminous aggregate (coarse), bituminous surface-treatment aggregate, railroad ballast, and other graded coarse aggregate.
4/ Includes stone sand (concrete), stone sand (bituminous mix or seal), screening (undesignated), and other fine aggregate.
5/ Includes graded road base or subbase and crusher run (select material or fill), unpaved road surfacing, and other coarse and fine aggregates.
6/ Includes reported and estimated production without a breakdown by end use.

TABLE 5
MASSACHUSETTS: CONSTRUCTION SAND AND GRAVEL SOLD OR USED IN 1997,
BY MAJOR USE CATEGORY 1/

Use	Quantity (thousand metric tons)	Value (thousands)	Value per ton
Concrete aggregate (including concrete sand)	4,000	$24,400	$6.10
Plaster and gunite sands	76	670	8.82
Concrete products (blocks, bricks, pipe, decorative, etc.)	21	169	8.05
Asphaltic concrete aggregates and other bituminous mixtures 2/	389	3,030	7.78
Road base and coverings	1,240	6,530	5.27
Fill	2,510	6,870	2.73
Snow and ice control	538	2,430	4.51
Railroad ballast	50	165	3.30
Other miscellaneous uses 3/	156	614	3.94
Unspecified: 4/			
Actual	1,220	3,670	3.01
Estimated	3,270	23,000	7.02
Total or average	13,500	71,500	5.31

1/ Data are rounded to three significant digits; may not add to totals shown.
2/ Includes road and other stabilization (lime).
3/ Includes filtration.
4/ Includes reported and estimated production without a breakdown by end use.

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TABLE 6
MASSACHUSETTS: CONSTRUCTION SAND AND GRAVEL SOLD OR USED IN 1997,
BY USE AND DISTRICT 1/

(Thousand metric tons and thousand dollars)

Use	District 1		District 2		District 3	
	Quantity	Value	Quantity	Value	Quantity	Value
Concrete aggregate	843	4,200	805	4,790	2,360	15,500
Concrete products 2/	5	81	32	226	60	532
Asphaltic concrete aggregate 3/	169	2,100	174	721	46	207
Road base and coverings	290	1,570	423	2,120	526	2,840
Fill	590	851	737	2,000	1,190	4,020
Snow and ice control	93	585	248	796	197	1,040
Railroad ballast	--	--	50	165	--	--
Other miscellaneous uses 4/	W	W	W	W	W	W
Unspecified: 5/						
Actual	W	W	W	W	W	W
Estimated	490	1,870	71	333	2,710	20,800
Total	2,480	11,300	3,570	12,900	7,430	47,400

W Withheld to avoid disclosing company proprietary data; included in "Total."
1/ Data are rounded to three significant digits; may not add to totals shown.
2/ Includes plaster and gunite sands.
3/ Includes road and other stabilization (lime).
4/ Includes filtration.
5/ Includes reported and estimated production without a breakdown by end use.

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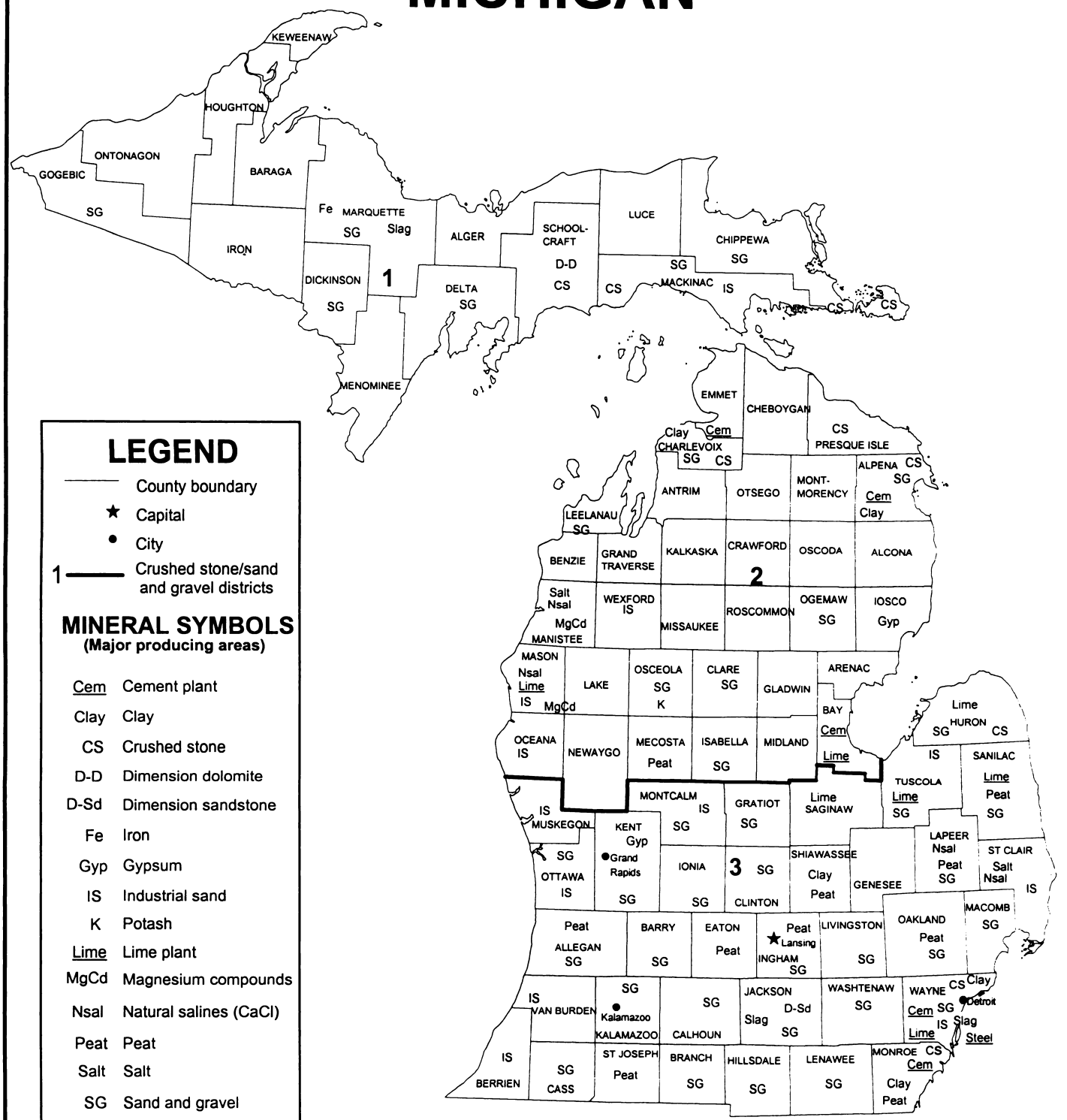
MICHIGAN



LEGEND

- County boundary
- ★ Capital
- ● City
- 1 —— Crushed stone/sand and gravel districts

MINERAL SYMBOLS
(Major producing areas)

Cem	Cement plant
Clay	Clay
CS	Crushed stone
D-D	Dimension dolomite
D-Sd	Dimension sandstone
Fe	Iron
Gyp	Gypsum
IS	Industrial sand
K	Potash
Lime	Lime plant
MgCd	Magnesium compounds
Nsal	Natural salines (CaCl)
Peat	Peat
Salt	Salt
SG	Sand and gravel
Slag	Slag
Steel	Iron and steel plant

0 100 Kilometers

Source: Michigan Department of Environmental Quality, Geological Survey Division/U.S. Geological Survey (1998)

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THE MINERAL INDUSTRY OF MICHIGAN

This chapter has been prepared under a Memorandum of Understanding between the U.S. Geological Survey and the Michigan Department of Environmental Quality, Geological Survey Division, for collecting information on all nonfuel minerals.

In 1998, the preliminary estimated value[1] of nonfuel mineral production for Michigan was $1.75 billion, according to the U.S. Geological Survey (USGS). This was an increase of more than 5% in 1997,[2] and followed a 7.1% increase from 1996 to 1997. The State rose to seventh from ninth in rank among the 50 States in total nonfuel mineral production value, of which Michigan accounted for more than 4% of the U.S. total.

Michigan continued to be the Nation's second leading iron ore-producing State in 1998, and iron ore was by value the State's leading nonfuel mineral. Portland cement (first in 1997) was second, followed by construction sand and gravel and magnesium compounds. In 1998, most mineral commodities increased in value, led by iron ore, up more than $40 million, portland cement up $26 million, magnesium compounds up $12 million, potash up $10 million, and construction sand and gravel and salt up about $6 million each. Reduced values of approximately $9 million in bromine and about $3 million each in crude gypsum and industrial sand and gravel were the only significant decreases.

In 1997, the value of most minerals produced in the State increased, led by construction sand and gravel, portland cement (table 1), iron ore, magnesium compounds, and crushed stone (up $13 million each), and bromine (up $10 million). Smaller yet significant increases also occurred for potash, masonry cement, and crude gypsum. Only salt, miscellaneous crushed stone, dimension dolomite and sandstone, and lime showed decreases (all small) in value.

Compared with USGS estimates of the quantities produced in the other 49 States in 1998, Michigan remained first[2] in magnesium compounds and iron oxide pigments; second in iron ore, industrial sand and gravel, and peat and second of two bromine-producing States; third of three States that produce potash; fourth in portland cement and crude gypsum; and sixth in masonry cement. The State rose to 7th from 10th in salt, dropped to 3d from 2d in construction sand and gravel, and was a significant producer of crushed stone, lime, and common clays. Michigan remained fifth in the Nation in the manufacture of raw steel with an estimated output of about 6.5 million metric tons, as reported by the American Iron and Steel Institute.

The following narrative information was provided by Michigan's Department of Natural Resources (DNR), Land and Mineral Services Division[3] (LMSD). In metal mining, the Tilden and Empire Mines, both located in Marquette County and operated by Cleveland Cliffs Iron Co., continued to produce large quantities of iron ore pellets. Cleveland Cliffs ships several varieties of pellets by train and lake freighter to iron producers in the United States and Canada. The Caledonia Mine located in Ontonagon County and operated by Red Metal Minerals Co. supplied limited quantities of copper and related mineral specimens to collectors and museums worldwide.

Regarding industrial minerals, the Detroit Salt Co., L.C., began mining rock salt at depth in the Detroit area in 1998. The mine had been idle since the previous owner, International Salt Co., halted operations a number of years ago. Quarries throughout the State produce limestone and dolomite for aggregates, as well as for fluxstone, cement manufacture, and other uses. Oglebay Norton Co. bought Specialty Minerals, Inc.'s Port Inland (high calcium and dolomitic limestone) operations in Schoolcraft and Mackinac Counties (Skillings, 1998). The new name of the operating company is Global Stone Port Inland, Inc. Also in Schoolcraft County, Inwood Stone Products produced dimension stone from a small quarry for use in building construction.

Exploration

According to the LMSD, three companies continued very limited scale exploration projects for base and precious metals. According to the Geological Survey Division (GSD) of the Michigan Department of Environmental Quality (DEQ) no exploration drilling was performed under the Mineral Well Act as of late 1998. On the other hand, in regard to dimension stone resources, field investigations of possible new quarries in Michigan were being conducted by H. James Bourque and Associates of Sault Ste. Marie, MI. Funded by the Michigan Jobs Commission, this work was the continuation of an ongoing project to inventory and test potential building stone resources begun a number of years ago by Michigan

[1]The terms "nonfuel mineral production" and related "values" encompass variations in meaning, depending on the minerals or mineral products. Production may be measured by mine shipments, mineral commodity sales, or marketable production (including consumption by producers) as is applicable to the individual mineral commodity.

All 1998 USGS mineral production data published in this chapter are preliminary estimates as of February 1999 and are expected to change. For some mineral commodities (for example, construction sand and gravel, crushed stone, and portland cement), estimates are updated periodically. To obtain the most current information, please contact the appropriate USGS mineral commodity specialist. A telephone listing for the specialists may be retrieved over the Internet at http://minerals.usgs.gov/minerals/contacts/comdir.html; by using MINES FaxBack at (703) 648-4999 from a fax machine with a touch-tone handset (request Document #1000 for a telephone listing of all mineral commodity specialists); or by calling USGS information at (703) 648-4000 for the specialist's name and number. All Mineral Industry Surveys—mineral commodity, State, and country—also may be retrieved over the Internet at http://minerals.usgs.gov/minerals; facsimile copies may be obtained from MINES FaxBack.

[2]Values, percentage calculations, and rankings for 1997 may vary from the *Minerals Yearbook, Area Reports: Domestic 1997, Volume II*, owing to the revision of preliminary 1997 to final 1997 data. Data for 1998 are preliminary and expected to change, while related rankings may also be subject to change.

[3]The text of mineral industry information was authored by Milton A. Gere, Jr., Geologist, Minerals Lease Management Section, Land and Mineral Services Division, Department of Natural Resources.

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Technological University. Several building stone producers visited some of the potential quarry sites during 1998.

Legislation and Government Programs

Act 154 of Michigan's Public Acts of 1997 may affect private ownership of severed metallic mineral rights. The December 1997 Act shortened the time between recordings of severed metallic mineral rights under the merchantable record title to 20 years from 40 years. Severed metallic mineral rights not recorded would revert to the surface owner of record. Those with unrecorded severed metallic mineral rights were given a 3-year window in which to record them. The deadline was set for December 22, 2000.

The GSD reported the receipt of large quantities of core donated to its Geological Core and Sample Repository at Marquette. Information regarding sample inventory and visiting information may be obtained from the following DEQ Internet website: http://www.deq.state.mi.us/gsd/core.html#three.

Leasing of State-Owned Mineral Lands.—The State owned approximately 2.4 million hectares of mineral rights and more than 10 million hectares of Great Lakes bottomlands. State-owned mineral lands leasing is managed by the Minerals Lease Management Section (MLMS) of the LMSD. The MLMS reorganized and divided its operations into three units in 1998: the Oil and Gas Leasing Unit, the Metallic and Nonmetallic Minerals and Underground Gas Storage Leasing Unit, and the Revenue Verification Unit.

In 1998, three "direct leases" for metallic minerals were issued and 17 were terminated. Over 4,450 hectares were under lease in this program. Regarding nonmetallic (industrial) minerals, one salt lease and one salt rights sale were processed with finalization of the transactions expected during 1999. A special variation of the standard lease document was then developed for construction sand, gravel, cobbles, boulders, and clay. The new document is intended for use on select large, continuously used, State-owned sand and gravel pits to give long-term responsibility to a specific operator. This will replace a few of the annual permits, which adapt themselves best to smaller, less used pits. Nearly 120 hectares are under lease in the nonmetallic program. Michigan's lease rental, royalty, and other dollars collected in 1998 (derived from leases containing State mineral ownership) accounted for a mineral income of over $38.5 million. The Oil and Gas Leasing Program generated most of the income. The bulk of the income is deposited in the Natural Resources Trust Fund account and is used for recreational land purchases and projects by State and local government bodies.

Abandoned Underground Mines.—The Statewide Abandoned Underground Mine Inventory Project neared completion by yearend. Nearly 800 mines with about 2,000 shafts and openings were inventoried, field reviewed, and site evaluated for public safety needs. The project was funded by the State of Michigan and administered by the LMSD of the DNR under a contract with a professor from Michigan Tech University's Department of Mining Engineering. Cooperation of the various County Mine Inspectors proved valuable to the completion of the project.

In August, representatives from State, local, and Federal agencies and from universities and other organizations attended a conference in Houghton, MI, regarding the inhabitation of bats in Michigan's abandoned mines. At the meeting, sponsored by Bat Conservation International and others, participants discussed bat cage mine closure techniques and related needs. Some of Michigan's many abandoned underground mines are now home to many thousands of bats, which are valuable to insect control, etc. Proper bat cage structures at mine openings would provide public safety and allow bats to continue living and hibernating in selected abandoned mines.

Reference Cited

Skillings Mining Review, 1998, Oglebay Norton Co. concludes Port Inland Quarry acquisition: Skillings Mining Review, v. 87, no. 18, May 2, p. 11.

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TABLE 1
NONFUEL RAW MINERAL PRODUCTION IN MICHIGAN 1/ 2/

(Thousand metric tons and thousand dollars unless otherwise specified)

Mineral	1996		1997		1998 p/	
	Quantity	Value	Quantity	Value	Quantity	Value
Cement:						
Masonry	232	20,400 e/	289	23,800 e/	295	25,000
Portland	5,390	397,000 e/	5,700	422,000 e/	5,900	448,000
Clays: Common	652	3,410	712	3,750	726	3,820
Gemstones	NA	1	NA	1	NA	1
Gypsum, crude	1,590	14,400	1,920	17,300	1,820	13,900
Lime	785	42,700	802	42,600	832	42,800
Peat	168	4,650	176	4,990	173	4,260
Sand and gravel:						
Construction	53,800	197,000	62,000	223,000	61,700	229,000
Industrial	2,680	29,400	2,680	30,000	2,760	27,400
Stone: Crushed 3/	38,600	144,000	42,000	157,000	42,000	158,000
Combined values of bromine, iron ore (usable), iron oxide pigments (crude), magnesium compounds, potash, salt, and stone (crushed granite and miscellaneous, dimension dolomite and sandstone)	XX	695,000	XX	734,000	XX	795,000
Total	XX	1,550,000	XX	1,660,000	XX	1,750,000

e/ Estimated. p/ Preliminary. NA Not available. XX Not applicable.
1/ Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
2/ Data are rounded to three significant digits; may not add to totals shown.
3/ Excludes certain stones; kind and value included with "Combined values" data.

TABLE 2
MICHIGAN: CRUSHED STONE SOLD OR USED, BY KIND 1/

Kind	1996				1997			
	Number of quarries	Quantity (thousand metric tons)	Value (thousands)	Unit value	Number of quarries	Quantity (thousand metric tons)	Value (thousands)	Unit value
Limestone	22	30,300	$115,000	$3.78	21	33,900	$125,000	$3.70
Dolomite	6	8,330	29,100	3.50	6	8,120	31,800	3.92
Granite	1	(2/)	(2/)	(2/)	1	(2/)	(2/)	(2/)
Calcareous marl	1	7	20	2.86	2	W	W	W
Sandstone	1	7	120	17.14	1	W	W	W
Miscellaneous stone	1	(2/)	(2/)	(2/)	1	(2/)	(2/)	(2/)
Total	XX	38,600	144,000	3.72	XX	42,000	157,000	3.74

W Withheld to avoid disclosing company proprietary data; included in "Total." XX Not applicable.
1/ Data are rounded to three significant digits, except unit value; may not add to totals shown.
2/ Excluded from State total to avoid disclosing company proprietary data.

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TABLE 3
MICHIGAN: CRUSHED STONE SOLD OR USED BY PRODUCERS
IN 1997, BY USE 1/ 2/

Use	Quantity (thousand metric tons)	Value (thousands)	Unit value
Coarse aggregate (+1 1/2 inch):			
Riprap and jetty stone	98	$1,040	$10.65
Filter stone	89	395	4.44
Other coarse aggregate	19	78	4.11
Coarse aggregate, graded:			
Concrete aggregate, coarse	4,330	15,700	3.63
Bituminous aggregate, coarse	568	3,180	5.60
Bituminous surface-treatment aggregate	512	2,110	4.11
Railroad ballast	83	424	5.11
Other graded coarse aggregate	542	2,920	5.38
Fine aggregate (-3/8 inch):			
Stone sand, concrete	1	3	3.00
Stone sand, bituminous mix or seal	1,160	4,180	3.61
Screening, undesignated	546	1,990	3.65
Coarse and fine aggregates:			
Graded road base or subbase	2,630	11,200	4.24
Unpaved road surfacing	1,680	7,600	4.53
Crusher run or fill or waste	5	24	4.80
Other construction materials	(3/)	(3/)	(3/)
Agricultural:			
Agricultural limestone	103	768	7.46
Other agricultural uses	9	36	4.00
Chemical and metallurgical:			
Cement manufacture	6,520	13,900	2.13
Lime manufacture	(3/)	(3/)	(3/)
Flux stone	5,510	21,900	3.97
Unspecified: 4/			
Actual	15,700	63,100	4.02
Estimated	283	1,090	3.85
Total	42,000	157,000	3.74

1/ Data are rounded to three significant digits, except unit value; may not add to totals shown.
2/ Includes calcareous marl, dolomite, limestone, and sandstone; excludes granite and miscellaneous stone from State total to avoid disclosing company proprietary data.
3/ Withheld to avoid disclosing company proprietary data; included in "Total."
4/ Includes reported and estimated production without a breakdown by end use.

TABLE 4
MICHIGAN: CRUSHED STONE SOLD OR USED BY PRODUCERS IN 1997, BY USE AND DISTRICT 1/

(Thousand metric tons and thousand dollars)

Use	District 1		District 2		District 3	
	Quantity	Value	Quantity	Value	Quantity	Value
Construction aggregates:						
Coarse aggregate (+1 1/2 inch) 2/	W	W	(3/)	(3/)	W	W
Coarse aggregate, graded 4/	W	W	2,190	7,380	W	W
Fine aggregate (-3/8 inch) 5/	W	W	738	2,820	W	W
Coarse and fine aggregate 6/	W	W	1,090	3,930	W	W
Other construction materials 7/	2,960	10,600	--	--	5,580	27,100
Agricultural 8/	(3/)	(3/)	(3/)	(3/)	(3/)	(3/)
Chemical and metallurgical 9/	(3/)	(3/)	8,750	25,300	1,100	2,980
Unspecified: 10/						
Actual	(3/)	(3/)	(3/)	(3/)	(3/)	(3/)
Estimated	(3/)	(3/)	--	--	283	1,090
Total	9,860	35,200	22,200	76,200	9,980	45,900

W Withheld to avoid disclosing company proprietary data; included with "Other construction materials."
1/ Data are rounded to three significant digits; may not add to totals shown.
2/ Includes filter stone, riprap and jetty stone, and other coarse aggregate.
3/ Withheld to avoid disclosing company proprietary data; included in "Total."
4/ Includes concrete aggregate (coarse), bituminous aggregate (coarse), bituminous surface-treatment aggregate, and railroad ballast.
5/ Includes stone sand (bituminous mix or seal), stone sand (concrete), screening (undesignated), and other fine aggregate.
6/ Includes graded road base or subbase, unpaved road surfacing, and crusher run (select material or fill).
7/ Includes drain fields.
8/ Includes agricultural limestone and other agricultural uses.
9/ Includes cement manufacture, flux stone, and lime manufacture.
10/ Includes reported and estimated production without a breakdown by end use.

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TABLE 5
MICHIGAN: CONSTRUCTION SAND AND GRAVEL SOLD OR USED IN 1997,
BY MAJOR USE CATEGORY 1/

Use	Quantity (thousand metric tons)	Value (thousands)	Value per ton
Concrete aggregate (including concrete sand)	8,380	$30,400	$3.63
Plaster and gunite sands	386	1,750	4.52
Concrete products (blocks, bricks, pipe, decorative, etc.)	246	1,020	4.15
Asphaltic concrete aggregates and other bituminous mixtures 2/	9,190	30,800	3.35
Road base and coverings	10,300	29,700	2.87
Fill	5,850	13,600	2.33
Snow and ice control	553	2,190	3.95
Roofing granules	4	53	13.25
Filtration	40	331	8.28
Other miscellaneous uses 3/	630	3,500	5.56
Unspecified: 4/			
Actual	15,600	70,300	4.51
Estimated	10,800	39,400	3.65
Total or average	62,000	223,000	3.60

1/ Data are rounded to three significant digits, except value per ton; may not add to totals shown.
2/ Includes road and other stabilization (cement and lime).
3/ Includes railroad ballast.
4/ Includes reported and estimated production without a breakdown by end use.

TABLE 6
MICHIGAN: CONSTRUCTION SAND AND GRAVEL SOLD OR USED IN 1997,
BY USE AND DISTRICT 1/

(Thousand metric tons and thousand dollars)

Use	District 1		District 2		District 3		Unspecified districts	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
Concrete aggregate (including concrete sands)	261	1,620	946	3,000	7,170	25,800	--	--
Plaster and gunite sand	W	W	W	W	372	1,660	--	--
Concrete products	20	144	67	316	159	559	--	--
Asphaltic concrete aggregates 2/	W	W	W	W	8,380	28,300	202	445
Road base and coverings	630	1,850	1,650	4,330	7,970	23,300	91	200
Fill	455	790	582	822	4,820	12,000	--	--
Snow and ice control	57	160	165	333	331	1,690	--	--
Other miscellaneous uses 3/	268	1,070	W	W	W	W	--	--
Unspecified: 4/								
Actual	--	--	W	W	W	W	--	--
Estimated	1,540	5,280	1,490	4,940	7,770	29,100	--	--
Total	3,260	10,000	6,350	19,500	52,100	192,000	293	645

W Withheld to avoid disclosing company proprietary data; included in "Total."
1/ Data are rounded to three significant digits; may not add to totals shown.
2/ Includes road and other stabilization (cement and lime).
3/ Includes filtration, railroad ballast, and roofing granules.
4/ Includes reported and estimated production without a breakdown by end use.

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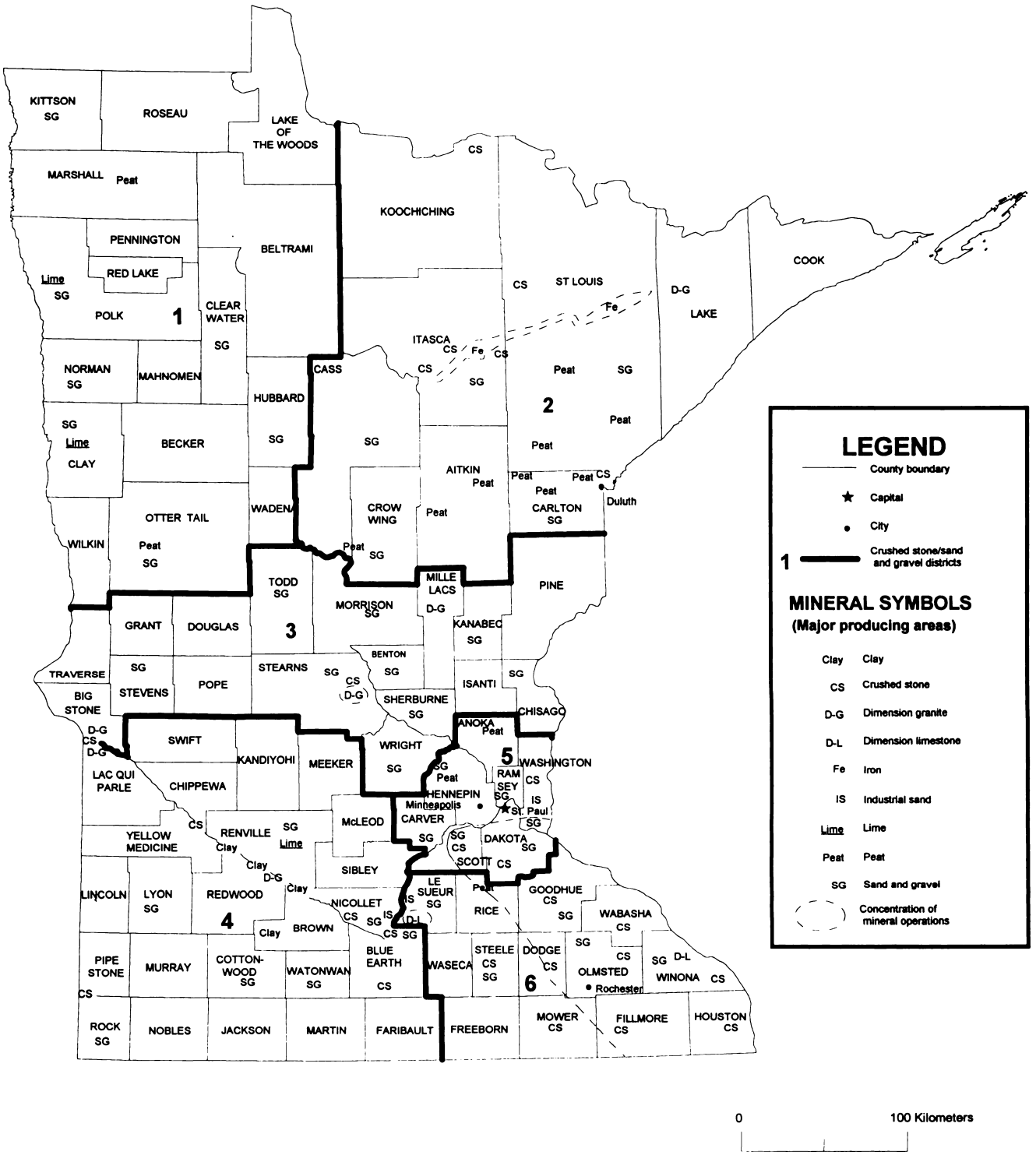
MINNESOTA



Source: Minnesota Department of Natural Resources, Division of Lands and Minerals/U.S. Geological Survey (1998)

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THE MINERAL INDUSTRY OF MINNESOTA

In 1998, the preliminary estimated value[1] of nonfuel mineral production for Minnesota was $1.73 billion, according to the U.S. Geological Survey (USGS). This was about a 3% increase from that of 1997,[2] and followed a 9% increase from 1996 to 1997. The State ranked eighth (seventh in 1997) among the 50 States in total nonfuel mineral production value, of which Minnesota accounted for more than 4% of the U.S. total.

In 1998, iron ore accounted for more than 85% of the State's nonfuel mineral production value, while construction sand and gravel and crushed stone accounted for about 7% and 5%, respectively. Most nonfuel minerals increased in value in 1998, led by an $40 million increase in the value of iron ore and a $13.5 million rise in crushed stone. Peat, lime, and common clay values also increased, while construction and industrial sand and gravel values showed small decreases. (Listings of mineral commodities are in descending order of change.) In 1997, Minnesota's increase in value resulted from the increased values of iron ore, construction sand and gravel, and crushed stone; the only significant decrease was about a $10 million drop in the value of industrial sand and gravel. Lime, peat, and gemstones showed small decreases, and common clays were unchanged.

Compared to USGS estimates of the quantities produced in the other 49 States in 1998, Minnesota remained first[2] in the Nation in iron ore. The State rose to 4th from 5th in peat and to 9th from 12th in dimension stone, while dropping to 10th from 7th in construction sand and gravel. Additionally, the State produced significant quantities of industrial sand and gravel.

The following narrative information was provided by the Minnesota Department of Natural Resources' (DNR) Division of Lands and Minerals (DLM).[3] Production data in the following text are those reported by the DLM, based on its own surveys and estimates. They may differ from some production figures reported to the USGS.

[1]The terms "nonfuel mineral production" and related "values" encompass variations in meaning, depending on the minerals or mineral products. Production may be measured by mine shipments, mineral commodity sales, or marketable production (including consumption by producers) as is applicable to the individual mineral commodity.

All 1998 USGS mineral production data published in this chapter are preliminary estimates as of February 1999 and are expected to change. For some mineral commodities (for example, construction sand and gravel, crushed stone, and portland cement), estimates are updated periodically. To obtain the most current information, please contact the appropriate USGS mineral commodity specialist. A telephone listing for the specialists may be retrieved over the Internet at http://minerals.usgs.gov/minerals/contacts/comdir.html; by using MINES FaxBack at (703) 648-4999 from a fax machine with a touch-tone handset (request Document #1000 for a telephone listing of all mineral commodity specialists); or by calling USGS information at (703) 648-4000 for the specialist's name and number. All Mineral Industry Surveys—mineral commodity, State, and country—also may be retrieved over the Internet at http://minerals.usgs.gov/minerals; facsimile copies may be obtained from MINES FaxBack.

[2]Values, percentage calculations, and rankings for 1997 may vary from the *Minerals Yearbook, Area Reports: Domestic 1997, Volume II*, owing to the revision of preliminary 1997 to final 1997 data. Data for 1998 are preliminary and expected to change, while related rankings may also be subject to change.

[3]Maryanna Harstad, Senior Planner, authored the text of State mineral industry information provided by the DLM.

Metals

According to the DLM, in 1998, the iron mining industry in Minnesota produced about 47.5 million metric tons of iron ore, nearly all of which was in concentrated pellet form. Based on DLM data, this was up 1.8 million tons from that of 1997 and accounted for more than 73% of domestic production that was supplied to the U.S. steel industry. [Based on USGS data, the State's 1998 production was down about 700,000 tons from nearly 48 million tons produced in 1997 and was about 64% of the domestic supply (including imports and exports) of nearly 74 million tons.] Production occurred primarily at seven taconite plants on the Mesabi iron range in northeastern Minnesota. Inland Steel Mining Co. became Ispat Inland Inc. in 1998 as Ispat International N.V. completed its acquisition of Inland Steel Co. Ispat Inland Inc. is now the owner and operator of the Minorca Mine. The DLM projected that production in 1999 was expected to be down from 1998 as two of the seven taconite plants announced reductions because of a surge of foreign steel imports into the United States.

Industrial Minerals

Minnesota's aggregate industry produces two types of materials: 1) sand and gravel mined from glacial or alluvial deposits, and 2) crushed rock from two subgroups—carbonates, limestone, and dolomite from quarries in southeastern Minnesota where natural gravel is scarce, and noncarbonates, including granite, quartzite, or traprock from quarries elsewhere in the State. Aggregate has been or is currently being mined in all of the State's 87 counties. An estimated 51 million tons or more of aggregate is consumed each year in Minnesota, the value of which exceeds $187 million. The current statewide production ratio of natural gravel to crushed stone is estimated to be roughly 3:1. Industry trade associations estimate that there are roughly 1,200 aggregate producers. Moreover, some of the same quarries that produce crushed limestone and dolomite used as aggregate also produce granular carbonate rock, which is used for soil amendment or for the manufacture of cement. The Minnesota Department of Agriculture (MDA) analyzes the granular carbonate soil amendment, commonly called ag-lime, to assess the neutralization potential. The MDA compilation lists 1998 total sales of 885,000 tons of ag-lime, of which more than 530,000 tons (60%) was primary production from Minnesota quarries.

Aggregate consumption continued to rise in Minnesota in four roughly equal, general categories of use–public roads, public works projects, private residential construction, and commercial/industrial applications. Using public roads as an example, more than 214,000 kilometers of public roadway must be maintained in the State, and according to the Minnesota Department of Transportation (MNDOT), total

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government investment in the State's transportation infrastructure was projected to be $2.4 billion for the 3-year period 1997-99. Aggregate consumption generally is driven by the factors of the economy and the population. According to the DLM, growth in the aggregate industry annually has been roughly 2% to 3% in recent years. Minnesota's population is projected to rise at a rate of 48,000 per year.

The State's "North Shore" corridor along Lake Superior has a relative scarcity of aggregate resources. The DNR worked on a project for MNDOT and for Lake County to identify new and potential areas of aggregate resources in this area to meet future road construction project needs.

In 1997, a diverse group of organizations met informally to discuss mutual concerns related to aggregate mining in Minnesota. An "Ad Hoc Aggregate Committee" (AHAC) was subsequently formed and has since been further enhanced with participation from State agencies, local government, the aggregate industry, trade associations, and The Nature Conservancy. The committee's goals have been to identify and highlight common areas of concern and urgency relative to aggregate resources. In 1998, the committee collected key information from a variety of sources about Minnesota aggregate resources, which is summarized in a 1998 report entitled "Minnesota Aggregate Resources—Road to the 21st Century."

In 1998, the Minnesota legislature appointed a 12-member Aggregate Resources Task Force (ARTF), for which the AHAC provides information and assistance in setting the Task Force's agenda. The ARTF, which includes four members from the State's House of Representatives, four from the State Senate, two from local government, one member from the aggregate industry, and one member with experience in prairie conservation, examines issues regarding the need for and use of the State's aggregate resources. During 1999, the Task Force's plan was to seek input from the aggregate industry, State agencies, county and local units of government, environmental organizations, and other interested parties on a variety of topics such as: resource inventory, resource depletion, mining practices, nuisance problems, safety, competing land uses, land use planning, native prairie conservation, environmental review, permit requirements, reclamation, recycling, transportation of aggregates, and the aggregate material tax. The Task Force was scheduled to report its findings to the State legislature on February 1, 2000.

Clay production is derived from seven mines, mainly for two general purposes. Kaolin is mined for use in Portland cement production and also for making bricks and tiles. Common clay and shale are also mined for bricks and tiles. Since 1995, four new mines have opened.

Exploration

In 1998, the State of Minnesota issued two nonferrous metallic mineral leases covering almost 310 hectares of land in St. Louis County to Rendrag, Inc. The leases were issued through the preference rights leasing system, under which State lands are continually available for leasing after having first been offered through public sale. These leases are the second and third leases issued under this lease-by-application system.

The State issued a peat lease to Koochiching County for 325 hectares in the Pine Island bog located northwest of Big Falls. The Pine Island Bog contains approximately 405 hectares of high-quality fibric sphagnum peat moss at an average thickness of 2 meters. Below the sphagnum cap lies a more decomposed, humic peat and a lower-quality sphagnum moss peat. The primary term of the lease is 3 years, during which time the county must secure an approved assignment of the lease to a qualified party, or the lease terminates. If the county secures a qualified developer, the lease extends for 22 more years—a total term of 25 years. The county was in the process of securing a qualified developer.

Cominco America, Inc., exploring for base and precision metals, drilled one hole to a depth of 153 meters in Carlton County. Lehmann Exploration Co. has been working on a program designed to locate hardrock metallic materials, principally platinum and palladium with associated copper and other minerals. The company drilled one hole to a depth of 780 meters in St. Louis County.

Minnesota Iron and Steel Co. (MIS) drilled a number of shallow holes at the old Butler Taconite operation to see if a concentrated enough bulk sample of taconite could be obtained. Polymet Mining Corp. drilled 14 reverse circulation holes at a site near properties formerly owned by AMAX Gold Corp. The total length of the holes was almost 2,000 meters. Cuttings from this operation were used to obtain a bulk sample for metallurgical testing for base and precious metals.

Legislation and Government Programs

The 1998 Minnesota Legislature appropriated $10 million for grants for the construction of as many as three direct reduction iron (DRI) processing facilities. The Commissioner of Trade and Economic Development and the Commissioner of Natural Resources must jointly agree on and issue the grants. The money will be available for grants until June 30, 2003. Prior to 1998, the Minnesota Legislature appropriated a significant amount of funding for development of DRI technology during the 1997 legislative session. The Department of Trade and Economic Development (DTED) received $3 million and the DNR received $500,000.

The DTED allocated funds for Minnesota Iron and Steel to support the company's plans to build the first U.S. fully integrated sheet minimill in Nashwauk, MN. The project incorporates a taconite iron ore mine, concentrator, pelletization plant, DRI facility, melting furnace, and a thin-slab caster and hot strip mill to produce high quality hot-rolled sheet steel for the automotive market.

Cleveland-Cliffs, Inc. applied for a grant to complete the feasibility study for its Northshore Project. Cleveland-Cliffs is exploring the possibility of constructing and operating a pig iron production facility at the company's Northshore plant in Silver Bay.

Partnership Projects.—The second annual Minnesota Minerals Education Workshop was held in August 1998 at Mankato State University. The 3-day workshop, a collaborative effort of State and Federal agencies, professional associations, educational institutions, and the mining industry, included speakers, hands-on classroom activities, and field trips about geologic formations and mining operations. Sixty-

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eight teachers from throughout the State took part in field trips to various quarries, processing facilities, and reclamation sites. Participants attended classroom sessions and presentations led by geologists, researchers, educators, and industry professionals and received a notebook of classroom activities, supporting resource materials, mineral identification kits, and samples of Minnesota rocks and minerals. Feedback from teachers attending these workshops has been overwhelmingly positive.

Research and Environmental Technologies.—The Iron Ore Cooperative Research Committee, representing the seven active taconite operations in Minnesota, the DNR, and three public and private minerals research organizations in the State, continued to collaborate on research projects designed to support the Minnesota's producing taconite operations. Current projects include process modeling, pelletizing binders, instrumentation, and application of advanced statistical methods.

The State, through the Minnesota Legislature, allocated an additional $500,000 of grant funding in 1998 to the $650,000 allocated in 1997 to support the demonstration of advanced technologies at the State's seven active taconite operations. The funds are available for research into technologies that reduce energy consumption, reduce environmental emissions, improve productivity, and/or improve pellet quality. The first recipient of grant funding was National Steel Pellet Co. for the installation of a mine and plant process control upgrade.

Ispat Inland Inc. proposed to dispose of taconite tailings in some of its existing mine pits to reduce the cost of tailings dike construction, risks associated with dam failure, the land required for tailings basins (including wetlands), energy usage for pumping tailings, and the potential for dust generation. Before such disposal can occur, the risk of impacting ground water quality must be assessed. The Minnesota Health Department (MHD) conducted a Health Risk Assessment to evaluate the proposal using information generated by the Iron Ore Cooperative Research In-Pit Taconite Tailings Disposal Project. This study identified fluoride, manganese, molybdenum, arsenic, and boron as parameters that occurred at levels near or above water quality standards in at least some field or experimental situations. The reactions controlling concentrations of all parameters except boron were determined through the study. In the assessment, the MHD concluded that Inland's project presented no significant risk to the health of the human population down-gradient from the operation. The information is also being applied for evaluations in the Supplemental Environmental Impact Statement being prepared by the DNR.

The DNR, in cooperation with several of the taconite producers, is studying the use of sewage sludge, composted solid municipal waste, paper wastes, and Duluth Harbor dredge spoils as soil amendments for revegetating coarse taconite tailings. Results to date have been successful. The long-term goal is to determine successful methods to use waste products accumulating on the landscape for mineland reclamation, thereby reducing disposal costs for the paper and municipal industries and reclamation costs for the taconite industry.

TABLE 1
NONFUEL RAW MINERAL PRODUCTION IN MINNESOTA 1/ 2/

(Thousand metric tons and thousand dollars unless otherwise specified)

Mineral	1996		1997		1998 p/	
	Quantity	Value	Quantity	Value	Quantity	Value
Clays: Common	11	W	W	W	W	W
Gemstones	NA	148	NA	5	NA	1
Iron ore, usable	46,800	1,330,000	47,900	1,430,000	47,200	1,470,000
Peat	20	1,540	29	1,500	25	1,660
Sand and gravel: Construction	31,800	107,000	34,500	127,000	32,900	124,000
Stone:						
Crushed	12,100	59,000	14,600	75,000	15,400	88,500
Dimension metric tons	25,400	10,700	35,000	18,300	35,000	18,300
Combined values of other industrial mineral and values indicated by symbol W	XX	35,100	XX	23,900	XX	23,700
Total	XX	1,540,000	XX	1,680,000	XX	1,730,000

p/ Preliminary. NA Not available. W Withheld to avoid disclosing company proprietary data; value included with "Combined values" data. XX Not applicable.
1/ Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
2/ Data are rounded to three significant digits; may not add to totals shown.

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TABLE 2
MINNESOTA: CRUSHED STONE SOLD OR USED, BY KIND 1/

Kind	1996 Number of quarries	1996 Quantity (thousand metric tons)	1996 Value (thousands)	1996 Unit value	1997 Number of quarries	1997 Quantity (thousand metric tons)	1997 Value (thousands)	1997 Unit value
Limestone	42 r/	6,990 r/	$32,400 r/	$4.63 r/	32	7,350	$35,600	$4.85
Granite	4	2,130	11,200	5.27	4	W	W	W
Dolomite	4 r/	2,030 r/	9,940 r/	4.91 r/	4	3,080	16,900	5.49
Sandstone and quartzite	8 r/	W	W	W	5	W	W	W
Traprock	1	W	W	W	--	--	--	--
Total	XX	12,100	59,000	4.88	XX	14,600	75,000	5.15

r/ Revised. W Withheld to avoid disclosing company proprietary data; included in "Total." XX Not applicable.
1/ Data are rounded to three significant digits; may not add to totals shown.

TABLE 3
MINNESOTA: CRUSHED STONE SOLD OR USED BY PRODUCERS IN 1997, BY USE 1/ 2/

Use	Quantity (thousand metric tons)	Value (thousands)	Unit value
Coarse aggregate (+1 1/2 inch):			
Macadam	47	$295	$6.28
Riprap and jetty stone	218	2,000	9.19
Filter stone	145	883	6.09
Other coarse aggregate	W	W	15.15
Coarse aggregate, graded:			
Concrete aggregate, coarse	702	5,060	7.21
Bituminous aggregate, coarse	183	1,310	7.14
Bituminous surface-treatment aggregate	89	635	7.13
Railroad ballast	793	5,300	6.68
Other graded coarse aggregate	W	W	6.57
Fine aggregate (-3/8 inch):			
Stone sand, concrete	14	57	4.07
Stone sand, bituminous mix or seal	343	1,860	5.41
Screening, undesignated	42	192	4.57
Other fine aggregate	W	W	4.28
Coarse and fine aggregates:			
Graded road base or subbase	2,350	11,400	4.83
Unpaved road surfacing	400	1,530	3.83
Terrazzo and exposed aggregate	W	W	8.64
Crusher run or fill or waste	45	309	6.87
Other coarse and fine aggregates	W	W	4.85
Other construction materials	3,050	17,000	5.57
Agricultural:			
Agricultural limestone	230	1,260	5.49
Poultry grit and mineral food	(3/)	(3/)	22.58
Special:			
Asphalt fillers or extenders	5	23	4.60
Other specified uses not listed	(3/)	(3/)	8.47
Unspecified: 4/			
Actual	4,130	18,600	4.51
Estimated	1,660	6,100	3.69
Total	14,600	75,000	5.15

W Withheld to avoid disclosing company proprietary data; included with "Other construction materials."
1/ Data are rounded to three significant digits, except unit value; may not add to totals shown.
2/ Includes dolomite, granite, limestone, sandstone, quartzite, and traprock.
3/ Withheld to avoid disclosing company proprietary data; included in "Total."
4/ Includes reported and estimated production without a breakdown by end use.

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TABLE 4
MINNESOTA: CRUSHED STONE SOLD OR USED BY PRODUCERS IN 1997, BY USE AND DISTRICT 1/ 2/

(Thousand metric tons and thousand dollars)

Use	District 3		District 4		District 5		District 6	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
Construction aggregates:								
Coarse aggregate (+1 1/2 inch) 3/	--	--	131	1,120	309	2,690	W	W
Coarse aggregate, graded 4/	W	W	W	W	1,170	7,720	W	W
Fine aggregate (-3/8 inch) 5/	W	W	W	W	(4/)	(4/)	W	W
Coarse and fine aggregate 6/	W	W	413	2,140	3,560	17,900	505	1,970
Other construction materials 7/	--	--	W	W	W	W	--	--
Agricultural 8/	--	--	W	W	W	W	W	W
Special 9/	--	--	--	--	W	W	--	--
Other miscellaneous use	--	--	--	--	--	--	--	--
Unspecified: 10/								
Actual	W	W	W	W	--	--	W	W
Estimated	W	W	428	1,890	W	W	692	2,890
Total	2,640	12,300	2,940	17,600	5,640	31,300	3,340	13,900

W Withheld to avoid disclosing company proprietary data; included in "Total."
1/ Data are rounded to three significant digits; may not add to totals shown.
2/ Production reported in District 2 was included in "District 3" to avoid disclosing company proprietary data; no crushed stone production in District 1.
3/ Includes filter stone, macadam, riprap and jetty stone, and other coarse aggregate.
4/ Includes concrete aggregate (coarse), bituminous aggregate (coarse), bituminous surface-treatment aggregate, railroad ballast, and other graded coarse aggregate.
5/ Includes stone sand (concrete), stone sand (bituminous mix or seal), screening (undesingnated), and other fine aggregate.
6/ Includes crusher run (select material or fill), graded road base or subbase, other coarse and fine aggregates, terrazzo and exposed aggregate, and unpaved road surfacing.
7/ Includes roofing granules and waste material.
8/ Includes agricultural limestone and poultry grit and mineral food.
9/ Includes asphalt fillers or extenders.
10/ Includes reported and estimated production without a breakdown by end use.

TABLE 5
MINNESOTA: CONSTRUCTION SAND AND GRAVEL SOLD OR USED IN 1997,
BY MAJOR USE CATEGORY 1/

Use	Quantity (thousand metric tons)	Value (thousands)	Value per ton
Concrete aggregate (including concrete sand)	8,510	$38,800	$4.56
Plaster and gunite sands	132	908	6.88
Concrete products (blocks, bricks, pipe, decorative, etc.)	251	977	3.89
Asphaltic concrete aggregates and other bituminous mixtures	3,450	17,900	5.18
Road base and coverings	9,990	28,300	2.84
Road stabilization (cement)	136	838	6.16
Road stabilization (lime)	7	29	4.14
Fill	1,820	3,640	2.00
Snow and ice control	223	559	2.51
Railroad ballast	231	770	3.33
Roofing granules	28	119	4.25
Filtration	34	248	7.29
Other miscellaneous uses	303	892	2.94
Unspecified: 2/			
Actual	2,050	9,330	4.54
Estimated	7,350	23,200	3.16
Total or average	34,500	127,000	3.67

1/ Data are rounded to three significant digits; may not add to totals shown.
2/ Includes reported and estimated production without a breakdown by end use.

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TABLE 6
MINNESOTA: CONSTRUCTION SAND AND GRAVEL SOLD OR USED IN 1997, BY USE AND DISTRICT 1/

(Thousand metric tons and thousand dollars)

Use	District 1		District 2		District 3	
	Quantity	Value	Quantity	Value	Quantity	Value
Concrete aggregate (including concrete sand)	970	5,380	542	2,350	1,570	5,200
Concrete products 2/	W	W	81	506	154	675
Asphaltic concrete aggregates (and other bituminous mixtures)	360	1,140	W	W	1,380	4,730
Road base and coverings	1,260	3,150	1,080	3,180	4,200	10,100
Fill	121	172	161	375	213	312
Snow and ice control	33	99	40	88	72	151
Other miscellaneous uses 3/	196	463	470	1,880	W	W
Unspecified: 4/						
Actual	W	W	W	W	W	W
Estimated	1,710	5,060	511	1,810	1,060	3,360
Total	4,710	15,700	3,740	12,900	8,880	27,600

	District 4		District 5		District 6	
	Quantity	Value	Quantity	Value	Quantity	Value
Concrete aggregate (including concrete sand)	491	2,560	W	W	W	W
Concrete products 2/	54	311	W	W	W	W
Asphaltic concrete aggregates (and other bituminous mixtures)	494	4,350	546	2,950	W	W
Road base and coverings	999	3,030	2,330	8,510	120	404
Fill	175	563	938	1,620	208	594
Snow and ice control	47	130	W	W	W	W
Other miscellaneous uses 3/	W	W	W	W	W	W
Unspecified: 4/						
Actual	W	W	W	W	W	W
Estimated	1,230	4,910	1,090	2,940	1,750	5,170
Total	4,020	17,900	10,200	40,300	2,930	12,100

W Withheld to avoid disclosing company proprietary data; included in "Total."
1/ Data are rounded to three significant digits; may not add to totals shown.
2/ Includes plaster and gunite sands.
3/ Includes filtration, railroad ballast, road stabilization, and roofing granules.
4/ Includes reported and estimated production without a breakdown by end use.

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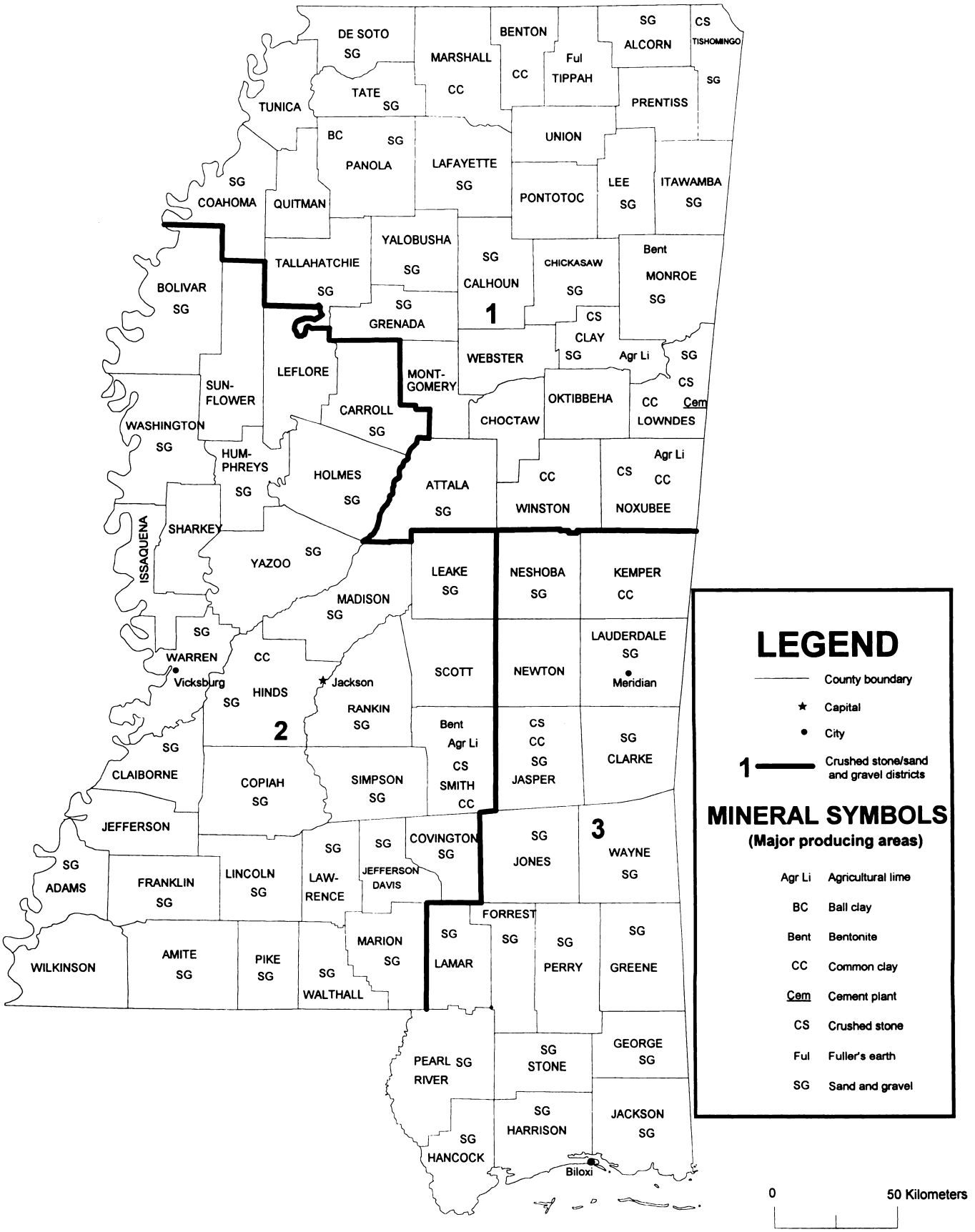
MISSISSIPPI



LEGEND

- County boundary
- ★ Capital
- ● City
- 1 Crushed stone/sand and gravel districts

MINERAL SYMBOLS

(Major producing areas)

Agr Li	Agricultural lime
BC	Ball clay
Bent	Bentonite
CC	Common clay
Cem	Cement plant
CS	Crushed stone
Ful	Fuller's earth
SG	Sand and gravel

Source: Mississippi Department of Environmental Quality, Office of Geology/U.S. Geological Survey (1998)

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THE MINERAL INDUSTRY OF MISSISSIPPI

This chapter has been prepared under a Memorandum of Understanding between the U.S. Geological Survey and the Mississippi Department of Environmental Quality, Office of Geology, for collecting information on all nonfuel minerals.

In 1998, the preliminary estimated value[1] of nonfuel mineral production for Mississippi was $190 million, according to the U.S. Geological Survey (USGS). This was a more than 8% increase from that of 1997,[2] following a 21.5% increase from 1996 to 1997.

Construction sand and gravel was Mississippi's leading nonfuel mineral, accounting for almost 39% of the State's value in 1998. It was followed by portland cement, fuller's earth, and crushed stone. Most of the State's rise in value in 1998 resulted from the increase in construction sand and gravel, further supported by smaller though significant increases in fuller's earth and portland cement (table 1). Only crushed stone and bentonite values decreased during the year. In 1997, a $23.6 million increase in the value of crushed stone plus small to moderate increases in the values of industrial sand and gravel and portland cement accounted for most of Mississippi's significant increase.

Based on USGS estimates of the quantities of minerals produced in the 50 States during 1998, Mississippi remained second[2] in fuller's earth and fourth in ball clay and bentonite. In addition to construction sand and gravel, significant quantities of common clays were produced in the State.

[1]The terms "nonfuel mineral production" and related "values" encompass variations in meaning, depending on the minerals or mineral products. Production may be measured by mine shipments, mineral commodity sales, or marketable production (including consumption by producers) as is applicable to the individual mineral commodity.

All 1998 USGS mineral production data published in this chapter are preliminary estimates as of February 1999 and are expected to change. For some mineral commodities (for example, construction sand and gravel, crushed stone, and portland cement), estimates are updated periodically. To obtain the most current information, please contact the appropriate USGS mineral commodity specialist. A telephone listing for the specialists may be retrieved over the Internet at http://minerals.usgs.gov/minerals/contacts/comdir.html; by using MINES FaxBack at (703) 648-4999 from a fax machine with a touch-tone handset (request Document #1000 for a telephone listing of all mineral commodity specialists); or by calling USGS information at (703) 648-4000 for the specialist's name and number. All Mineral Industry Surveys—mineral commodity, State, and country—also may be retrieved over the Internet at http://minerals.usgs.gov/minerals; facsimile copies may be obtained from MINES FaxBack.

[2]Values, percentage calculations, and rankings for 1997 may vary from the *Minerals Yearbook, Area Reports: Domestic 1997, Volume II*, owing to the revision of preliminary 1997 to final 1997 data. Data for 1998 are preliminary and expected to change, while related rankings may also be subject to change.

Metals produced in Mississippi, especially raw steel, were processed from materials received from other domestic and foreign sources.

The following narrative information was provided by the Mississippi Department of Environmental Quality's Office of Geology[3] (OG); the agency reported mining activity during 1998 for sand, gravel, industrial and brick-grade clays (including some of the highest-grade calcium bentonite in the world), as well as some quarrying for limestone and dolomite.

The OG's Mining and Reclamation Division (MRD), charged with enforcement of the Mississippi Surface Mining and Reclamation Act of 1977 (SMRA), regulates Mississippi's mining activities. The mining industry is one of the State's most important industries, contributing thousands of jobs and tens of millions of dollars to the Mississippi economy. The MRD has jurisdiction over about 6,900 hectares being mined in the State; this land area includes, in addition to the nonfuel minerals listed in table 1, the extraction of such materials as topsoil and other soils, borrow, and fill materials.

The OG and its divisions compile data based on its fiscal year (July 1 to June 30). In fiscal year 1998, MRD approved 47 new mining permits and performed nearly 1,200 inspections of existing mines. Mining operations using 1.6 hectares of land or less do not need a mining permit but have to submit a notice of exemption to MRD. In 1998, 114 notices of exempt operations were received. Active mining permits on file at the end of fiscal year 1998 totaled 780, while the total exemptions were 832.

The MRD continued to place emphasis on getting mined land reclaimed and put back into useful and productive purposes. In accordance with the SMRA, mine operators must post a performance bond that is released only upon satisfactory reclamation of the land affected by mining activities. In fiscal year 1998, more than 543 bond release hectares were reclaimed. More bond hectares were reclaimed and more final bond releases were granted in fiscal year 1998 than in any previous year.

[3]James E. Starnes, Geologist with the Mississippi Department of Environmental Quality's Office of Geology, provided the Mississippi mineral industry information.

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TABLE 1
NONFUEL RAW MINERAL PRODUCTION IN MISSISSIPPI 1/ 2/

(Thousand metric tons and thousand dollars unless otherwise specified)

Mineral	1996		1997		1998 p/	
	Quantity	Value	Quantity	Value	Quantity	Value
Clays:						
Ball	73	4,540	W	W	W	W
Bentonite	145	4,480	W	W	W	W
Common	534	3,610	502	3,500	513	3,530
Fuller's earth	379	27,800	388	28,100	369	30,800
Gemstones	NA	1	NA	1	NA	5
Sand and gravel: Construction	13,400	60,600	13,000	59,600	15,600	73,300
Stone: Crushed 3/	2,180	9,300	5,180	32,900	4,900	29,400
Combined values of cement (portland), sand and gravel (industrial), stone (crushed marl), and values indicated by symbol W	XX	33,500	XX	51,300	XX	52,600
Total	XX	144,000	XX	175,000	XX	190,000

p/ Preliminary. NA Not available. W Withheld to avoid disclosing company proprietary data; value included with "Combined values" data. XX Not applicable.
1/ Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
2/ Data are rounded to three significant digits; may not add to totals shown.
3/ Excludes certain stones; kind and value included with "Combined values" data.

TABLE 2
MISSISSIPPI: CRUSHED STONE SOLD OR USED, BY KIND 1/

Kind	1996				1997			
	Number of quarries	Quantity (thousand metric tons)	Value (thousands)	Unit value	Number of quarries	Quantity (thousand metric tons)	Value (thousands)	Unit value
Calcareous marl	1	(2/)	(2/)	(2/)	1	(2/)	(2/)	(2/)
Limestone	4	2,180	$9,300	$4.26	12	5,180	$32,900	$6.36
Total	XX	2,180	9,300	4.26	XX	5,180	32,900	6.36

XX Not applicable.
1/ Data are rounded to three significant digits; may not add to totals shown.
2/ Excluded from State total to avoid disclosing company proprietary data.

TABLE 3
MISSISSIPPI: CRUSHED STONE SOLD OR USED BY PRODUCERS
IN 1997, BY USE 1/ 2/

Use	Quantity (thousand metric tons)	Value (thousands)	Unit value
Coarse aggregate (+1 1/2 inch):			
Riprap and jetty stone	W	W	$6.31
Other coarse aggregate	707	3,750	5.31
Bituminous aggregate, coarse	W	W	5.54
Bituminous surface-treatment aggregate	W	W	5.77
Coarse aggregate, graded:			
Railroad ballast	W	W	5.75
Other graded coarse aggregate	1,150	7,090	6.19
Fine aggregate (-3/8 inch):			
Stone sand, concrete	W	W	5.70
Stone sand, bituminous mix or seal	W	W	5.47
Other fine aggregate	437	2,220	5.07
Coarse and fine aggregates:			
Crusher run or fill or waste	W	W	5.55
Other coarse and fine aggregates	1,430	13,100	9.19
Agricultural limestone	62	655	10.58
Chemical and metallurgical: Cement manufacture	W	W	3.40
Unspecified: Estimated 3/	W	W	W
Total	5,180	32,900	6.36

W Withheld to avoid disclosing company proprietary data; included in "Total."
1/ Data are rounded to three significant digits, except unit value; may not add to totals shown.
2/ Includes limestone; excludes calcareous marl to avoid disclosing company proprietary data.
3/ Includes reported and estimated production without a breakdown by end use.

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TABLE 4
MISSISSIPPI: CRUSHED STONE SOLD OR USED BY PRODUCERS IN 1997,
BY USE AND DISTRICT 1/ 2/ 3/

(Thousand metric tons and thousand dollars)

Use	District 1		District 2		Unspecified districts	
	Quantity	Value	Quantity	Value	Quantity	Value
Construction aggregates:						
Coarse aggregate (+1 1/2 inch) 4/	W	W	W	W	650	2,870
Coarse aggregate, graded 5/	W	W	W	W	902	3,970
Fine aggregate (-3/8 inch) 6/	W	W	W	W	399	1,770
Coarse and fine aggregate 7/	W	W	W	W	W	W
Agricultural 8/	W	W	W	W	W	W
Chemical and metallurgical 9/	W	W	--	--	--	--
Unspecified: 10/						
Actual	--	--	--	--	--	--
Estimated	--	--	W	W	--	--
Total	2,320	17,000	355	4,740	2,500	11,200

W Withheld to avoid disclosing company proprietary data; included in "Total."
1/ Data are rounded to three significant digits; may not add to totals shown.
2/ Excludes calcareous marl from State total to avoid disclosing company proprietary data.
3/ No production reported for District 3.
4/ Includes riprap and jetty stone and other coarse aggregate.
5/ Includes bituminous aggregate (coarse), bituminous surface-treatment, railroad ballast, and other graded coarse aggregates.
6/ Includes stone sand (concrete), stone sand (bituminous mix or seal), and other fine aggregate.
7/ Includes crusher run (select material or fill) and other coarse and fine aggregates.
8/ Includes agricultural limestone.
9/ Includes cement manufacture.
10/ Includes reported and estimated production without a breakdown by end use.

TABLE 5
MISSISSIPPI: CONSTRUCTION SAND AND GRAVEL SOLD OR USED IN 1997,
BY MAJOR USE CATEGORY 1/

Use	Quantity (thousand metric tons)	Value (thousands)	Value per ton
Concrete aggregate (including concrete sand)	4,870	$20,200	$4.16
Concrete products (blocks, bricks, pipe, decorative, etc.)	55	289	5.25
Asphaltic concrete aggregates and other bituminous mixtures	2,420	12,200	5.04
Road base and coverings	1,660	7,960	4.79
Fill	131	273	2.08
Other miscellaneous uses 2/	58	339	5.84
Unspecified: 3/			
Actual	1,840	8,530	4.63
Estimated	2,020	9,790	4.86
Total or average	13,000	59,600	4.57

1/ Data are rounded to three significant digits; may not add to totals shown.
2/ Includes filtration, plaster and gunite sands, and road and other stabilization (cement).
3/ Includes reported and estimated production without a breakdown by end use.

TABLE 6
MISSISSIPPI: CONSTRUCTION SAND AND GRAVEL SOLD OR USED IN 1997, BY USE AND DISTRICT 1/

(Thousand metric tons and thousand dollars)

Use	District 1		District 2		District 3		Unspecified districts	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
Concrete aggregate (including concrete sand)	1,730	7,960	2,650	10,700	330	730	149	808
Asphaltic concrete aggregates and other bituminous	W	W	893	4,510	W	W	100	252
Road base and covering	352	1,450	734	3,330	495	2,960	81	223
Other miscellaneous uses 2/	1,440	7,550	100	353	111	389	16	18
Unspecified 3/	1,920	9,330	1,130	5,610	807	3,380	--	--
Total	5,450	26,300	5,510	24,500	1,740	7,460	346	1,300

W Withheld to avoid disclosing company proprietary data; included with "Other miscellaneous uses."
1/ Data are rounded to three significant digits; may not add to totals shown.
2/ Includes concrete products, fill, filtration, plaster and gunite sand, and road and other stabilization (cement).
3/ Includes reported and estimated production without a breakdown by end use.

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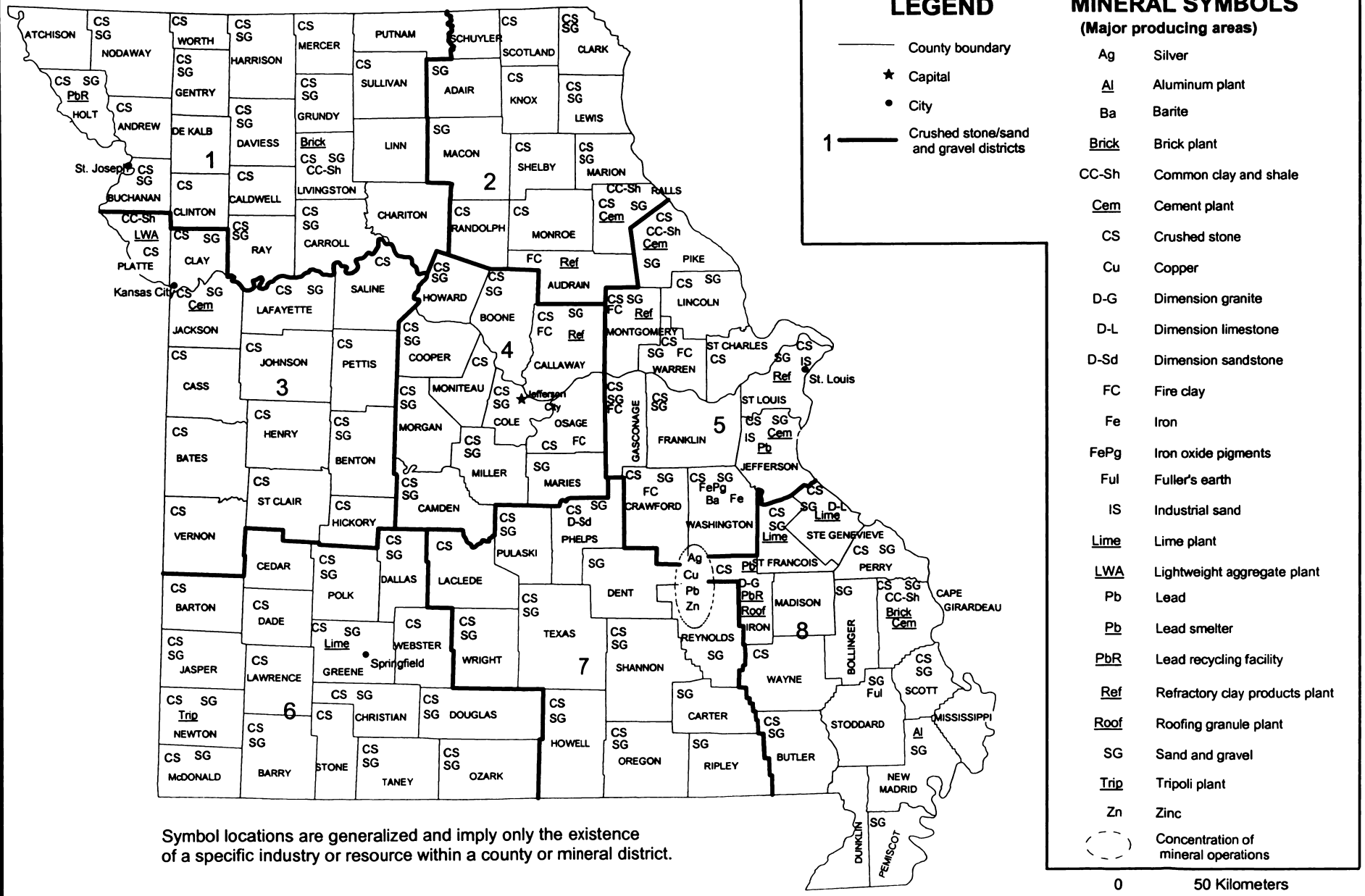
MISSOURI



Symbol locations are generalized and imply only the existence of a specific industry or resource within a county or mineral district.

Source: Missouri Department of Natural Resources, Division of Geology and Land Survey/U.S. Geological Survey (1998)

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THE MINERAL INDUSTRY OF MISSOURI

This chapter has been prepared under a Memorandum of Understanding between the U.S. Geological Survey and the Missouri Department of Natural Resources, Division of Geology and Land Survey, for collecting information on all nonfuel minerals.

In 1998, the preliminary estimated value[1] of nonfuel mineral production for Missouri was $1.36 billion, according to the U.S. Geological Survey (USGS). This was nearly a 4% increase from that of 1997,[2] following a 4.8% increase from 1996 to 1997. The State climbed in rank to 9th from 10th among the 50 States in total nonfuel mineral production value, of which Missouri accounted for more than 3% of the U.S. total.

Missouri, by a large measure, remained the top producer of lead in the Nation. The State produced more than three times the quantity of lead as that of the next highest producing State in 1998. However, crushed stone, by value, has been the State's foremost nonfuel mineral commodity since 1997, having traded places with lead, which was first in 1996. Except for several years in the mid-1980's and 1993-95, lead had been Missouri's leading nonfuel mineral since 1969. Crushed stone surpassed lead and portland cement in 1993 and ranked first through 1995. In 1998, the value of portland cement also surpassed that of lead.

In 1998, crushed stone, portland cement, and third- and fourth-ranked lead and lime combined to account for 88% of the State's total nonfuel mineral production value. Significantly increased values for crushed stone and portland cement plus a smaller increase in fuller's earth more than balanced decreases in lead, zinc, copper, and construction sand and gravel values (in descending magnitude of change), resulting in the State's net increase (table 1). All other changes in value in 1998 were small relative to these. In 1997, the State's increase in value mainly resulted from the increased values of portland cement, crushed stone, and lime plus a smaller rise in zinc. Decreases in lead and copper somewhat offset the year's gains.

Based on USGS preliminary estimates of the quantities produced in the 50 States in 1998, Missouri remained first[2] in lime; second in fire clays and iron oxide pigments; third in iron ore; fourth in zinc; fifth in portland cement and ball clay; and seventh in silver. The State rose to fifth from sixth in the production of crushed stone, to fourth from fifth in fuller's earth, and dropped from sixth to seventh in common clays. Additionally, the State was a significant producer of industrial sand and gravel and masonry cement.

The Missouri Department of Natural Resources, Division of Geology and Land Survey[3] (DGLS) provided the narrative information that follows:

Industrial Minerals

The crushed stone industry increased production an estimated 8% in 1998 from that of 1997 to reach a new alltime high for the State of 74.3 million metric tons; demand was expected to continue to be high in 1999. All urban areas had strong markets although some rural areas reported steady to weak markets. In the St. Louis and Kansas City markets, commercial work was exceptionally strong. Several producers reported difficulty in keeping up with demand. In contrast to this, a major issue facing the Missouri aggregate industry continued to be the status of the State highway program. The Missouri Department of Highways and Transportation withdrew its previously submitted 15-year program because of funding problems. The Department replaced it with a 5-year program, and discussions continued in the Missouri Legislature regarding potential solutions for the lack of funding to meet the State's transportation needs.

Consolidation continued in the aggregate industry with the continued purchases of small or regional producers by major national stone companies. APAC, Inc. purchased Lake Ozark Construction Industry, Inc. from Clarkson Construction. Lake Ozark had many crushed stone, sand and gravel, and ready-mix plants in the central Missouri area. APAC also bought City-Wide Asphalt Co., Inc. in Jackson County and a quarry near Gallatin in Daviess County. Capitol Quarries, Inc. purchased Smith Quarries near Salem in Dent County; Central Stone Co. purchased the Greensburg Quarry in Scotland; and Carthage Crushed Limestone Co. was sold to AMERICOLD in midyear.

Although the estimated overall construction sand and gravel production was down somewhat (table 1), according to the DGLS, the industry also had a good year in 1998. Many producers reported to the DGLS to have had excellent years in

[1]The terms "nonfuel mineral production" and related "values" encompass variations in meaning, depending on the minerals or mineral products. Production may be measured by mine shipments, mineral commodity sales, or marketable production (including consumption by producers) as is applicable to the individual mineral commodity.

All 1998 USGS mineral production data published in this chapter are preliminary estimates as of February 1999 and are expected to change. For some mineral commodities (for example, construction sand and gravel, crushed stone, and portland cement), estimates are updated periodically. To obtain the most current information, please contact the appropriate USGS mineral commodity specialist. A telephone listing for the specialists may be retrieved over the Internet at http://minerals.usgs.gov/minerals/contacts/comdir.html; by using MINES FaxBack at (703) 648-4999 from a fax machine with a touch-tone handset (request Document #1000 for a telephone listing of all mineral commodity specialists); or by calling USGS information at (703) 648-4000 for the specialist's name and number. All Mineral Industry Surveys–mineral commodity, State, and country–also may be retrieved over the Internet at http://minerals.usgs.gov/minerals; facsimile copies may be obtained from MINES FaxBack.

[2]Values, percentage calculations, and rankings for 1997 may vary from the *Minerals Yearbook, Area Reports: Domestic 1997, Volume II*, owing to the revision of preliminary 1997 to final 1997 data. Data for 1998 are preliminary and expected to change, while related rankings may also be subject to change.

[3]Ardel Rueff, Geologist, authored the text of State mineral industry information submitted by the Division of Geology and Land Survey.

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their businesses. Havin Material Service of St. Clair, Franklin County, purchased Virginia Mines Sand and Gravel Co., also of St. Clair. St. Charles Sand Co. of Bridgeton, St. Louis County, purchased a German-made air jig to remove lignite, a common deleterious material in Missouri River sand. The yet-to-be-settled U.S. Army Corps of Engineers' management plan for the Missouri River remained a concern to dredge operators along that river. Industry feels that high spring water flows will limit dredging, increase floating debris, and may restrict barge movement. Final management plans for the river have not been announced by yearend.

The cement industry also shared in the active construction market; several plants reported selling all of 1998 production. These trends were expected to continue into 1999. Shaft sinking continued at the Lafarge Cement Corp. plant at Sugar Creek, Jackson County, and plant-site preparation started with completion scheduled for the year 2000. Lone Star Cement Co. began preliminary planning for an expansion project at its Cape Girardeau County plant. The company completed evaluation of a large tract of nearby reserves in adjacent Scott County and tentative plans call for limestone to be moved from the proposed quarry by conveyor to the existing cement manufacturing facility.

With regard to fire clays, Global Industrial Technology (GIT) purchased the A. P. Green Industries Inc. in July 1998. It was later merged with GIT's Harbison-Walker Refractories Co. subsidiary. As a result of this, Harbinson Walker's manufacturing plant near Fulton, Callaway County, was closed although operations at the rotary kiln continued. The mining and exploration departments were combined.

Markets for structural clay products continued strong in 1998 following a year of significantly increased production in 1997; a similar demand for these raw materials was expected to continue on into 1999. A sound economy and low interest rates led the way for strong demand for brick in the housing market. Additionally, low fuel prices also helped the industry, both at the kiln and in transportation.

Metals

Because of low metal prices, 1998 was a difficult operating year for the base-metal industry. In April 1998, the Doe Run Co. announced its intention to purchase the assets of ASARCO, Incorporation's Missouri Lead Division. The deal was completed in September 1998 and consisted of the acquisition of two lead-zinc mines, Sweetwater and West Fork, and the Glover lead smelter and refinery, all located in southeast Missouri. Asarco retained royalty interests in the properties (Giancola, 1999, p. 93). During 1997, Asarco completed a modernization of the Glover plant, meeting all Federal ambient air standards as of that year (Giancola, 1999, p. 33). In the fall of 1998, Doe Run withdrew its application for prospecting permits for several tracts in the Winona (Shannon County) area. According to the company, special stipulations placed on the permits by the U.S. Department of the Interior were too restrictive and might set a precedent affecting the industry on a national basis.

The Doe Run Co. began refurbishing the Higdon Mine (lead-zinc deposit) in Perry County with plans to collect bulk samples for metallurgical testing. During the 1950's, the National Lead Co. discovered the Higdon ore body with assistance from the Defense Minerals Exploration Administration. Development of the ore body was started in 1965 but suspended in 1967 after two shafts were sunk. The ore reportedly is similar to that found in the Mine La Motte and Fredericktown, Madison County area, which contains lead, zinc, copper, nickel and cobalt and is an area of former mining activity. The Mine La Motte (Mine La Motte Corp.) and Madison (National Lead Co.) mines closed in the late 1950's and 1961, respectively, owing to a combination of reasons—depressed metal prices, progressively lower grades of remaining ores, and depletion of some of the remaining proven ore bodies.

Reference Cited

Giancola, Diane, ed., 1999, American Mines Handbook 1999: Don Mills, Ontario, Canada, Southam Mining Publications Group, p. 33, 93.

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TABLE 1
NONFUEL RAW MINERAL PRODUCTION IN MISSOURI 1/ 2/

(Thousand metric tons and thousand dollars unless otherwise specified)

Mineral	1996		1997		1998 p/	
	Quantity	Value	Quantity	Value	Quantity	Value
Cement : Portland	4,530	293,000 e/	4,730	321,000 e/	4,900	340,000
Clays:						
Ball	13	W	W	W	W	W
Common	849	3,250	1,050	4,140	1,070	4,220
Fire	223	3,220	291	4,270	259	3,970
Fuller's earth	283	W	W	W	W	W
Copper 3/	W	W	8	19,300	7	12,300
Gemstones	NA	108	NA	W	NA	W
Sand and gravel: Construction	9,820	35,600	9,530	35,600	8,360	32,100
Stone: Crushed	67,000	325,000	68,500	350,000	74,300	409,000
Combined values of barite (1996), cement iron ore (usable), iron oxide pigments (crude), lime, sand and gravel (industrial), silver, stone (dimension granite), zinc, and values indicated by symbol W	XX	591,000	XX	573,000	XX	555,000
Total	XX	1,250,000	XX	1,310,000	XX	1,360,000

e/ Estimated. p/ Preliminary. NA Not available. W Withheld to avoid disclosing company proprietary data; value included with "Combined "Combined values" data. XX Not applicable.
1/ Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
2/ Data are rounded to three significant digits; may not add to totals shown.
3/ Recoverable content of ores, etc.

TABLE 2
MISSOURI: CRUSHED STONE SOLD OR USED, BY KIND 1/

Kind	1996				1997			
	Number of quarries	Quantity (thousand metric tons)	Value (thousands)	Unit value	Number of quarries	Quantity (thousand metric tons)	Value (thousands)	Unit value
Limestone 2/	191 r/	62,800 r/	$302,000 r/	$4.81 r/	176	64,700	$330,000	$5.10
Dolomite	27 r/	3,090 r/	15,500 r/	5.01 r/	23	2,580	12,900	5.01
Granite	2	W	W	7.31	2	W	W	6.77
Sandstone	1	W	W	2.26	1	W	W	2.32
Traprock	1	W	W	4.36	1	W	W	4.96
Total	XX	67,000	325,000	4.85	XX	68,500	350,000	5.11

r/ Revised. W Withheld to avoid disclosing company proprietary data; included in "Total." XX Not applicable.
1/ Data are rounded to three significant digits; may not add to totals shown.
2/ Includes "limestone-dolomite" reported with no distinction between the two.

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TABLE 3
MISSOURI: CRUSHED STONE SOLD OR USED BY PRODUCERS
IN 1997, BY USE 1/ 2/

Use	Quantity (thousand metric tons)	Value (thousands)	Unit value
Coarse aggregate (+1 1/2 inch):			
Macadam	222	$1,180	$5.31
Riprap and jetty stone	2,600	9,610	3.69
Filter stone	191	892	4.67
Other coarse aggregate	626	2,970	4.74
Coarse aggregate, graded:			
Concrete aggregate, coarse	2,210	12,000	5.46
Bituminous aggregate, coarse	1,880	10,300	5.50
Bituminous surface-treatment aggregate	291	1,810	6.23
Other graded coarse aggregate 3/	3,290	27,300	8.31
Fine aggregate (-3/8 inch):			
Stone sand, concrete	W	W	6.03
Stone sand, bituminous mix or seal	131	710	5.42
Screening, undesignated	946	3,410	3.61
Other fine aggregate	101	583	5.77
Coarse and fine aggregates:			
Graded road base or subbase	9,150	41,500	4.53
Unpaved road surfacing	2,350	12,200	5.18
Terrazzo and exposed aggregate	W	W	10.11
Crusher run or fill or waste	607	2,670	4.39
Other coarse and fine aggregates	1,740	8,220	4.72
Other construction materials 4/	393	2,190	5.56
Agricultural:			
Agricultural limestone	985	4,910	4.98
Poultry grit and mineral food	(5/)	(5/)	6.53
Chemical and metallurgical:			
Cement manufacture	4,350	14,800	3.41
Lime manufacture	2,410	11,300	4.70
Dead-burned dolomite manufacture	(5/)	(5/)	7.59
Flux stone	(5/)	(5/)	6.47
Chemical stone	(5/)	(5/)	4.96
Special:			
Asphalt fillers or extenders	28	125	4.46
Roofing granules	(5/)	(5/)	11.03
Other miscellaneous uses: Other specified uses not listed 6/	208	1,010	4.88
Unspecified: 7/			
Actual	14,900	84,600	5.67
Estimated	18,100	89,500	4.94
Total	68,500	350,000	5.11

W Withheld to avoid disclosing company proprietary data; included with "Other construction materials."
1/ Data are rounded to three significant digits, except unit value; may not add to totals shown.
2/ Includes dolomite, granite, limestone, limestone-dolomite, sandstone, and traprock.
3/ Includes railroad ballast.
4/ Includes stone sand (concrete) and terrazzo and exposed aggregate.
5/ Withheld to avoid disclosing company proprietary data; included in "Total."
6/ Includes waste material.
7/ Includes reported and estimated production without a breakdown by end use.

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TABLE 4
MISSOURI: CRUSHED STONE SOLD OR USED BY PRODUCERS IN 1997,
BY USE AND DISTRICT 1/

(Thousand metric tons and thousand dollars)

Use	District 1		District 2		District 3		District 4	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
Construction aggregates:								
Coarse aggregate (+1 1/2 inch) 2/	(3/)	(3/)	W	W	W	W	133	572
Coarse aggregate, graded 4/	155	1,080	W	W	W	W	585	2,780
Fine aggregate (-3/8 inch) 5/	(3/)	(3/)	W	W	W	W	--	--
Coarse and fine aggregate 6/	(3/)	(3/)	623	3,030	614	2,940	617	2,910
Other construction materials 7/	--	--	185	1,130	1,430	16,800	--	--
Agricultural 8/	(3/)	(3/)	(3/)	(3/)	(3/)	(3/)	(3/)	(3/)
Chemical and metallurgical 9/	--	--	(3/)	(3/)	(3/)	(3/)	--	--
Special 10/	--	--	--	--	--	--	--	--
Other miscellaneous use	--	--	--	--	(3/)	(3/)	--	--
Unspecified: 11/								
Actual	1,200	9,160	(3/)	(3/)	4,670	32,800	(3/)	(3/)
Estimated	1,500	7,440	2,500	13,500	2,110	11,000	2,680	12,900
Total	3,990	24,400	4,270	21,000	9,630	69,200	4,160	20,100

	District 5		District 6		District 7		District 8	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
Construction aggregates:								
Coarse aggregate (+1 1/2 inch) 2/	560	2,830	222	1,350	(3/)	(3/)	W	W
Coarse aggregate, graded 4/	1,840	11,100	1,780	11,200	(3/)	(3/)	1,910	8,580
Fine aggregate (-3/8 inch) 5/	863	2,970	W	W	(3/)	(3/)	W	W
Coarse and fine aggregate 6/	4,620	24,600	1,470	7,800	(3/)	(3/)	4,830	19,200
Other construction materials 7/	(3/)	(3/)	(3/)	(3/)	--	--	2,160	6,920
Agricultural 8/	(3/)	(3/)	323	1,990	(3/)	(3/)	(3/)	(3/)
Chemical and metallurgical 9/	(3/)	(3/)	(3/)	(3/)	--	--	4,090	16,100
Special 10/	--	--	--	--	--	--	(3/)	(3/)
Other miscellaneous use	(3/)	(3/)	(3/)	(3/)	--	--	--	--
Unspecified: 11/								
Actual	6,370	28,400	1,280	7,240	--	--	(3/)	(3/)
Estimated	5,590	25,600	2,720	14,400	716	3,360	299	1,330
Total	21,700	100,000	8,440	48,100	1,660	7,700	14,600	59,400

W Withheld to avoid disclosing company proprietary data; included with "Other construction materials."
1/ Data are rounded to three significant digits; may not add to totals shown.
2/ Includes filter stone, macadam, riprap and jetty stone, and other coarse aggregate.
3/ Withheld to avoid disclosing company proprietary data; included in "Total."
4/ Includes concrete aggregate (coarse), bituminous aggregate (coarse), bituminous surface-treatment aggregate, railroad ballast, and other graded coarse aggregate.
5/ Includes stone sand (concrete), stone sand (bituminous mix or seal), screening (undesignated), and other fine aggregate.
6/ Includes crusher run (select material or fill), graded road base or subbase, other coarse and fine aggregates, terrazzo and exposed aggregate, and unpaved road surfacing.
7/ Includes roofing granules and waste material.
8/ Includes agricultural limestone and poultry grit and mineral food.
9/ Includes cement manufacture, chemical stone for alkali works, dead-burned dolomite, flux stone, and lime manufacture.
10/ Includes asphalt fillers or extenders.
11/ Includes reported and estimated production without a breakdown by end use.

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TABLE 5
MISSOURI: CONSTRUCTION SAND AND GRAVEL SOLD OR USED IN 1997,
BY MAJOR USE CATEGORY 1/

Use	Quantity (thousand metric tons)	Value (thousands)	Value per ton
Concrete aggregate (including concrete sand) 2/	5,070	$17,800	$3.51
Concrete products (blocks, bricks, pipe, decorative, etc.)	103	470	4.56
Asphaltic concrete aggregates and other bituminous mixtures	236	993	4.21
Road base and coverings	538	1,820	3.38
Fill	209	929	4.44
Snow and ice control	110	459	4.17
Other miscellaneous uses 3/	119	1,020	8.55
Unspecified: 4/			
Actual	1	6	6.00
Estimated	3,140	12,100	3.84
Total or average	9,530	35,600	3.73

1/ Data are rounded to three significant digits; may not add to totals shown.
2/ Includes plaster and gunite sands.
3/ Includes filtration and roofing granules.
4/ Includes reported and estimated production without a breakdown by end use.

TABLE 6
MISSOURI: CONSTRUCTION SAND AND GRAVEL SOLD OR USED IN 1997, BY USE AND DISTRICT 1/ 2/

(Thousand metric tons and thousand dollars)

Use	District 1		District 2		District 4		District 5	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
Concrete aggregate and concrete products 3/	61	361	W	W	W	W	3,460	11,700
Asphaltic concrete aggregates and road base materials 4/	62	281	W	W	W	W	W	W
Other miscellaneous uses 5/	--	--	--	--	W	W	W	W
Unspecified: 6/								
Actual	1	6	--	--	--	--	--	--
Estimated	359	1,360	162	692	1,060	3,760	887	3,940
Total	483	2,010	256	1,060	2,320	8,320	4,610	17,300

Use	District 6		District 7		District 8	
	Quantity	Value	Quantity	Value	Quantity	Value
Concrete aggregate and concrete products 3/	W	W	114	365	529	2,320
Asphaltic concrete aggregates and road base materials 4/	W	W	73	222	432	1,360
Other miscellaneous uses 5/	W	W	--	--	--	--
Unspecified: 6/						
Actual	--	--	(7/)	(7/)	(7/)	1
Estimated	27	231	208	778	444	1,310
Total	62	506	395	1,370	1,410	5,000

W Withheld to avoid disclosing company proprietary data; included in "Total."
1/ Production reported in District 3 was included with District 4 to avoid disclosing company proprietary data.
2/ Data are rounded to three significant digits; may not add to totals shown.
3/ Includes plaster and gunite sands.
4/ Includes fill and snow and ice control.
5/ Includes filtration and roofing granules.
6/ Includes reported and estimated production without a breakdown by end use.
7/ Less than 1/2 unit.

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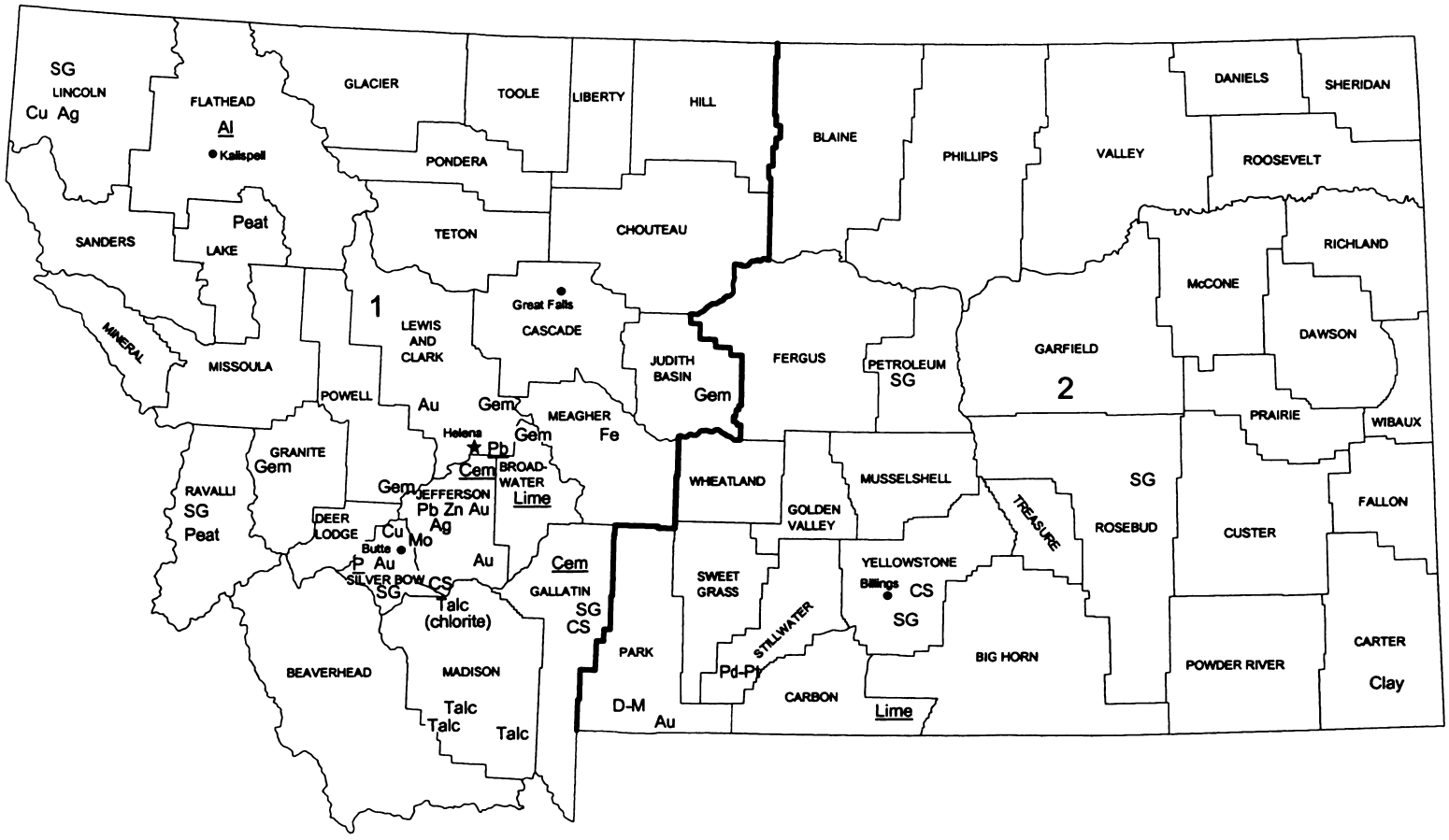
MONTANA



LEGEND

- County boundary
- Capital
- City
- 1 — Crushed stone/sand and gravel districts

MINERAL SYMBOLS
(Major producing areas)

Ag	Silver
Al	Aluminum plant
Au	Gold
Cem	Cement plant
Clay	Clay
Cu	Copper
CS	Crushed stone
D-M	Dimension marble
Fe	Iron
Gem	Gemstones
Lime	Lime plant
Mo	Molybdenum
P	Phosphate rock plant
Peat	Peat
Pb	Lead smelter
Pd-Pt	Palladium-platinum
SG	Sand and gravel
Talc	Talc minerals
Zn	Zn

0 — 100 Kilometers

Source: Montana Bureau of Mines and Geology/U.S. Geological Survey (1998)

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THE MINERAL INDUSTRY OF MONTANA

This chapter has been prepared under a Memorandum of Understanding between the U.S. Geological Survey and the Montana Bureau of Mines and Geology for collecting information on all nonfuel minerals.

In 1998, the preliminary estimated value[1] of nonfuel mineral production for Montana was $500 million, according to the U.S. Geological Survey (USGS). This was a $2 million increase from that of 1997,[2] following an identical increase in 1997 from that of 1996. The State ranked 29th (27th in 1997) in the Nation in nonfuel mineral production value, of which Montana accounted for more than 1% of the U.S. total.

Overall, metallic minerals accounted for more than 73% of the State's total nonfuel mineral value. By value, copper was Montana's leading nonfuel mineral, followed by gold. Palladium was the State's third-leading nonfuel mineral commodity.

In 1998, large increases in the values of palladium, platinum, and molybdenum (table 1), plus smaller increases in portland cement, construction sand and gravel, and crushed stone, more than compensated for decreases in gold, zinc, copper, bentonite, and talc. This resulted in a small net gain in nonfuel mineral production value for the year. (All listings are in descending order of the magnitude of change.) Other values that increased in 1998 were those of silver, iron ore, masonry cement, lime, dimension stone, and common clay. Other values that decreased included those of industrial sand and gravel, gemstones, industrial garnet, and peat. All other mineral commodity values virtually remained the same. In 1997, a similar gain in value resulted from significant increases in palladium, platinum, and zinc, plus smaller increases in bentonite, crushed stone, and lead. These more than balanced out decreases in copper, gold, and construction sand and gravel, and smaller though significant decreases in molybdenum, silver, talc, and lime. All other changes were small and inconsequential to the net result.

Based on USGS estimates of the quantities produced in the 50 States in 1998, Montana continued as the only[2] U.S. producer of primary palladium and platinum. The State remained first in the production of talc; third of three industrial garnet-producing States; fourth in lead; fifth in copper, molybdenum and zinc; and sixth in gold and silver. Montana dropped in rank to 3d from 2d in bentonite and to 10th from 5th in gemstones.

The Montana Bureau of Mines and Geology (MBMG) provided the narrative information that follows.[3] During 1998, the State's minerals industry experienced low and generally declining prices for most commodities, and a continued slowness in the mine permitting process.

Metals

Sixteen years after the first public meeting and 12 years after submission of its permit application (October 1987), ASARCO Incorporated's Rock Creek copper-gold project, northwest of Missoula, neared the completion of its permitting process. The approval of the final Environmental Impact Statement (EIS) was anticipated for summer 1999, with operating permits soon to follow. Canyon Resources Corp.'s McDonald Gold project (north of Helena) was in a very uncertain situation with $70 million invested thus far. The project's EIS was incomplete and significantly overdue, and the project was over budget by about three times its anticipated cost. As a result of passage of a public initiative banning future developments of cyanide leaching projects, Initiative 137 (I-137), Canyon Resources was not able to use the only economically viable processing alternative that the company felt it had. Canyon Resources indicated it may file what is called a "taking" lawsuit to recapture its forfeited investment and projected profits.

Early in 1999, Pegasus Gold Inc.'s Diamond Hill gold mine, southeast of Helena, closed temporarily, having been affected by the parent corporation's 1998 bankruptcy proceedings. According to the MBMG, although the bankruptcy proceedings appeared near completion, mining companies communicated to them that those proceedings have further complicated obtaining bond financing by raising the cost. The bonds became more difficult to obtain because of the possibility that the bonding companies could be held responsible for payment of the final reclamation in lieu of the precedent of the Pegasus Gold forfeiture. In 1998, the mine had been developed to the 300-meter level and was then producing over 900 metric tons per day.

Following a long EIS process, Placer Dome Inc.'s Golden Sunlight gold-silver mine, near Butte, was awarded permits to expand its waste rock dumps. The Montana Environmental Information Council challenged the decision in court. Loss of the court case would force closure of the mine because a law

[1]The terms "nonfuel mineral production" and related "values" encompass variations in meaning, depending on the minerals or mineral products. Production may be measured by mine shipments, mineral commodity sales, or marketable production (including consumption by producers) as is applicable to the individual mineral commodity.

All 1998 USGS mineral production data published in this chapter are preliminary estimates as of February 1999 and are expected to change. For some mineral commodities (for example, construction sand and gravel, crushed stone, and portland cement), estimates are updated periodically. To obtain the most current information, please contact the appropriate USGS mineral commodity specialist. A telephone listing for the specialists may be retrieved over the Internet at http://minerals.usgs.gov/minerals/contacts/comdir.html; by using MINES FaxBack at (703) 648-4999 from a fax machine with a touch-tone handset (request Document #1000 for a telephone listing of all mineral commodity specialists); or by calling USGS information at (703) 648-4000 for the specialist's name and number. All Mineral Industry Surveys—mineral commodity, State, and country—also may be retrieved over the Internet at http://minerals.usgs.gov/minerals; facsimile copies may be obtained from MINES FaxBack.

[2]Values, percentage calculations, and rankings for 1997 may vary from the *Minerals Yearbook, Area Reports: Domestic 1997, Volume II*, owing to the revision of preliminary 1997 to final 1997 data. Data for 1998 are preliminary and expected to change, while related rankings may also be subject to change.

[3]Robin B. McCulloch, Staff Mining Engineer, authored the text of mineral industry information submitted by the Montana Bureau of Mines and Geology.

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established as part of the passage of I-137 does not allow the company to reapply for the dump expansion.

Pegasus Gold Inc. canceled an expansion of its Zortman gold-silver project, near Malta, and commenced final reclamation for the project's closure. As of early 1999, TVX Gold Inc. was unable to find a buyer for its Mineral Hill gold-silver mine, near Gardiner. If not sold, the company is likely to progress with plans to reclaim the property in 1999.

Stillwater Mining Co.'s platinum, palladium, gold, copper (not yet recovered), nickel, and rhodium operations were the bright spot in Montana's metal mining industry. The company's operations are located at three sites between Billings and Big Timber—two mines, the Stillwater Mine and the East Boulder Mine project and a smelter in Columbus. Whereas Stillwater endured low capitalization and prices when other commodities and companies in past years have been somewhat more fortunate, relatively recent shortages in international commodity markets for platinum-group metals have provided an excellent development environment for Stillwater.

Stillwater secured adequate futures contracts in order to fund an ambitious expansion program. At the smelter site in Columbus, work was initiated on a new copper and nickel recovery plant and a new 90 ton-per-day smelting furnace. The Stillwater mill was undergoing modifications to increase throughput to almost 3,000 tons per day, up from about 1,800 tons per day. Mill construction was essentially complete. At the Stillwater Mine, development was underway to provide the necessary stopes and access for the projected mining rate. A record of decision was issued for a new pond and slurry line project to diminish the company's environmental risk. Two tunnel-boring machines are being used in twin 5,600-meter drives to the J-M Reef formation, near Big Timber. Completion is expected before 2000, and production will commence at the East Boulder Mine shortly thereafter. As reported to the MBMG, Stillwater Mining projected that an annual production level of nearly 16,000 kilograms (500,000 troy ounces) of palladium and platinum was attainable for the company within 5 years, and that finding enough skilled labor to meet production quotas was its most likely obstacle.

Industrial Minerals

In the industrial minerals sector, the cement industry continued to produce at capacity, but the talc industry experienced a significant loss in its share of the market during the time of the Asian economic crises. Luzenac America spent the last year reclaiming its chlorite mine, southeast of Butte.

Cominco American Resources, Inc. put its industrial minerals division mining properties up for sale, in particular its two garnet operations in Alder and Dillon. The Alder operation (Ruby Garnet) negotiated with a number of companies; Sweetwater Garnet ceased operations in August and began welcoming inquiries for buyers.

Exploration

Exploration activity levels continued to decline with few companies having sufficient funds available for investment owing to low commodity prices. As related to the MBMG, available funds were often redirected from Montana because the companies reported difficulty in securing financing on Montana projects. According to the MBMG, no industrial minerals exploration was being conducted at yearend 1998 on into the early part of 1999. In 1988, 56 companies spent $23.6 million on 75 exploration projects. In 1998, 19 companies, including only three major companies, spent less than $450,000 on 21 exploration projects.

On the western side of the Elkhorns, east of Boulder, Treminco Resources Ltd. completed an eight-hole, due-diligence drilling program on the Elkhorn gold project. Holding interests in the property were Newmont Gold Co., Goldfields Mining Co., and Santa Fe Pacific Gold Co. Treminco took an option on the property and entered a letter of intent in April 1998 to acquire the property from Hospah/Santa Fe Gold Co. The company is planning to develop the East Butte portion of the package as an underground mine and estimates 540 tons per day will be mined using a mechanized open stope process with some backfilling. Treminco plans to haul the ore to the Placer Dome's Golden Sunlight facility for processing. Costs were estimated to be between $105 and $211 per troy ounce of gold for the first 3 years, and Treminco anticipated that production would begin in summer 1999.

Hanover Gold Company Inc. maintained an extensive drilling program in the Virginia City area as evaluation of its Alder Gulch/Brown's Gulch property package continued through the first half of 1998. The results, although not definitive, were encouraging in delineation of economic mineralization. By August, as the anti-cyanide I-137 campaign appeared to be gaining support, Hanover suspended exploration, awaiting results of the election. Although the prospect was not specifically designated as heap leach, the company indicated a waning enthusiasm to proceed under current legal and economic restraints. After I-137 passed in November, Hanover Gold dropped plans for much of its Alder Gulch property package and soon after closed its Montana offices.

Legislation and Government Programs

In 1998, Montana's metal mining industry experienced possibly its most difficult year of the current decade. Low commodity prices coupled with continuing challenges in the courts and in the legislative arena from the environmental community have produced a steady retreat by mining companies from the State. In the spring of 1998, work on I-137 began as an effort to institute a ban all new surface mines, or expansions of surface mines, that use cyanide in a leach circuit. The mining industry's case was hampered by two factors: 1) initiative 125, passed in a previous legislative session, forbid the use of corporate dollars or employee's time in addressing initiative campaigns; and 2) fines were levied against businesses that failed to file with the Commissioner of Political Practices as Political Action Committees , after they contributed money and committed employee's time to fight ballot issues during the 1996 election. The Commissioner, under State administrative law 44.10.321, determined that any two individuals discussing a ballot issue constitutes a political action committee, and must report their activities or be fined.

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Fines incurred during the 1996 campaign were not settled until December 1998.

The combination of bans and fines significantly limited the mining industry response during the I-137 campaign. Initiative 125 was declared unconstitutional 12½ days before the election, giving the mining industry limited time to prepare and fully communicate to the voters its side of the issues that I-137's proponents had been presenting to the public for months. Although I-137 was significantly defeated in some counties, the initiative was approved in November by 52% of the votes Statewide. Initiative 137 was challenged immediately in the courts, while bills to nullify the initiative were drafted for the upcoming legislature.

During August, many gold mining companies that were active in the State put all planned expenditures and investments scheduled for activities in Montana on hold until after the election. As a result of passage of I-137, nearly all exploration and/or development work being conducted on pre-production properties has remained curtailed.

In contrast, bills favorable to the mineral industry and business in general appeared to be headed for legislative approval. An exploration incentive bill, modeled after Alaska legislation, easily passed through the State Senate and was under study in that government body's Taxation Committee.

Bills designed to reduce property taxes also received a favorable response. While bills addressing changes to I-137 have been the subjects of vigorous debate, these issues remained unresolved.

Outlook

During the last 10 years, no new major mines have been permitted in Montana. As related to the MBMG, metal-mining companies seem to perceive that permits for large mines are likely to be unachievable. Conversely, permits for small to medium-sized operations do not appear to be a problem, especially if they are for underground mine operations.

As expressed by the MBMG, the future of metals exploration and development in Montana depends on several items: commodity prices, final disposition of the cyanide ban, the mining industry's and the business community's perception of Montana's business environment, and the perceived ability to permit a major mine in the State.

TABLE 1
NONFUEL RAW MINERAL PRODUCTION IN MONTANA 1/ 2/

(Thousand metric tons and thousand dollars unless otherwise specified)

Mineral		1996 Quantity	1996 Value	1997 Quantity	1997 Value	1998 p/ Quantity	1998 p/ Value
Clays:		34	W	W	W	W	W
Gemstones		NA	1,840	NA	1,120	NA	504
Gold 3/	kilograms	9,440	118,000	10,200	109,000	8,700	82,800
Lead 3/	metric tons	7,970	8,580	9,230	9,470	9,000	8,930
Palladium	kilograms	6,100	25,500	8,400	49,700	11,100	67,800
Platinum	do.	1,840	23,500	2,610	33,200	3,460	45,200
Sand and gravel: Construction		9,260	35,800	8,390	30,800	8,760	33,100
Stone:		2,000	8,580	2,600	10,600	2,700	12,100
Zinc 3/	metric tons	19,400	21,900	21,500	30,600	21,000	24,200
Combined values of cement, clays [bentonite, fire (1996)], copper, garnet (industrial), iron ore (1996, 1998)], lime, molybdenum, peat, sand gravel [industrial, (1996-97)], silver, stone miscellaneous), talc and pyrophyllite, and values indicated by symbol W		XX	252,000	XX	223,000	XX	226,000
Total		XX	496,000	XX	498,000	XX	500,000

p/ Preliminary. NA Not available. W Withheld to avoid disclosing company proprietary data; value included with "Combined values" data. XX Not applicable.
1/ Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
2/ Data are rounded to three significant digits; may not add to totals shown.
3/ Recoverable content of ores, etc.

TABLE 2
MONTANA: CRUSHED STONE SOLD OR USED, BY KIND 1/

Kind	1996 Number of quarries	1996 Quantity (thousand metric tons)	1996 Value (thousands)	1996 Unit value	1997 Number of quarries	1997 Quantity (thousand metric tons)	1997 Value (thousands)	1997 Unit value
Limestone	13	1,540	$6,240	$4.06	23	2,020	$8,620	$4.27
Traprock	3	W	W	W	3	W	W	W
Sandstone and quartzite	3	W	W	W	5	W	W	W
Volcanic cinder and scoria	1	3	9	3.00	1	6	18	3.00
Miscellaneous stone	--	--	--	--	1	104	119	1.14
Total	XX	2,000	8,580	4.29	XX	2,600	10,600	4.09

W Withheld to avoid disclosing company proprietary data; included in "Total." XX Not applicable.
1/ Data are rounded to three significant digits; may not add to totals shown.

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TABLE 3
MONTANA: CRUSHED STONE SOLD OR USED BY PRODUCERS IN 1997,
BY USE 1/ 2/

Use	Quantity (thousand metric tons)	Value (thousands)	Unit value
Coarse aggregate (+1 1/2 inch): Riprap and jetty stone	13	$39	$3.00
Coarse aggregate, graded: Railroad ballast	W	W	5.51
Coarse and fine aggregates:			
Graded road base or subbase	72	160	2.22
Unpaved road surfacing	95	294	3.09
Other coarse and fine aggregates	W	W	2.00
Other construction materials	271	1,270	4.70
Chemical and metallurgical:			
Cement manufacture	(3/)	(3/)	4.00
Lime manufacture	(3/)	(3/)	7.00
Flux stone	(3/)	(3/)	2.04
Other miscellaneous uses: Acid neutralization	(3/)	(3/)	3.81
Unspecified: 4/			
Actual	104	119	1.14
Estimated	809	2,990	3.70
Total	2,600	10,600	4.09

W Withheld to avoid disclosing company proprietary data; included in "Other construction materials."
1/ Data are rounded to three significant digits; may not add to totals shown.
2/ Includes limestone, quartzite, sandstone, traprock and volcanic cinder and scoria.
3/ Withheld to avoid disclosing company proprietary data; included in "Total."
4/ Includes reported and estimated production without a breakdown by end use.

TABLE 4
MONTANA: CRUSHED STONE SOLD OR USED BY PRODUCERS IN 1997,
BY USE AND DISTRICT 1/

(Thousand metric tons and thousand dollars)

Use	District 1		District 2		Unspecified districts	
	Quantity	Value	Quantity	Value	Quantity	Value
Construction aggregates:						
Coarse aggregate (+1 1/2 inch) 2/	W	W	--	--	--	--
Coarse aggregate, graded 3/	W	W	--	--	--	--
Coarse and fine aggregate 4/	W	W	79	178	--	--
Other construction materials	372	1,590	--	--	--	--
Chemical and metallurgical 5/	1,190	5,590	--	--	--	--
Other miscellaneous uses 6/	(7/)	(7/)	--	--	--	--
Unspecified: 8/						
Actual	--	--	--	--	104	119
Estimated	(7/)	(7/)	649	2,570	--	--
Total	1,770	7,770	728	2,750	104	119

W Withheld to avoid disclosing company proprietary data; included with "Other construction materials."
1/ Data are rounded to three significant digits; may not add to totals shown.
2/ Includes riprap and jetty stone.
3/ Includes railroad ballast.
4/ Includes graded road base or subbase, unpaved road surfacing, and other coarse and fine aggregates.
5/ Includes cement manufacture, flux stone, and lime manufacture.
6/ Includes acid neutralization.
7/ Withheld to avoid disclosing company proprietary data; included in "Total."
8/ Includes reported and estimated production without a breakdown by end use.

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TABLE 5

MONTANA: CONSTRUCTION SAND AND GRAVEL SOLD OR USED IN 1997, BY MAJOR USE CATEGORY 1/

Use	Quantity (thousand metric tons)	Value (thousands)	Value per ton
Concrete aggregate (including concrete sand)	1,150	$5,390	$4.70
Plaster and gunite sands	2	6	3.00
Concrete products (blocks, bricks, pipe, decorative, etc.)	71	165	2.32
Asphaltic concrete aggregates and other bituminous mixtures	969	4,930	5.09
Road base and coverings 2/	3,130	9,750	3.11
Fill	507	1,650	3.25
Snow and ice control	254	914	3.60
Railroad ballast	20	99	4.95
Other miscellaneous uses 3/	123	465	3.78
Unspecified: 4/			
Actual	218	712	3.27
Estimated	1,950	6,720	3.45
Total or average	8,390	30,800	3.67

1/ Data are rounded to three significant digits; may not add to totals shown.
2/ Includes road and other stabilization (cement).
3/ Includes filtration.
4/ Includes reported and estimated production without a breakdown by end use.

TABLE 6
MONTANA: CONSTRUCTION SAND AND GRAVEL SOLD OR USED IN 1997, BY USE AND DISTRICT 1/

(Thousand metric tons and thousand dollars)

Use	District 1		District 2	
	Quantity	Value	Quantity	Value
Concrete aggregates (including concrete sand) 2/	973	4,090	246	1,480
Asphaltic concrete aggregates and road base materials 3/	2,640	10,000	1,460	4,680
Fill	396	1,180	111	472
Other miscellaneous uses 4/	376	1,340	22	137
Unspecified: 5/				
Actual	217	712	--	--
Estimated	1,320	4,510	626	2,210
Total	5,930	21,800	2,460	8,980

1/ Data are rounded to three significant digits; may not add to totals shown.
2/ Includes plaster and gunite sands.
3/ Includes road and other stabilization (cement).
4/ Includes filtration, railroad ballast, and snow and ice control.
5/ Includes reported and estimated production without a breakdown by end use.

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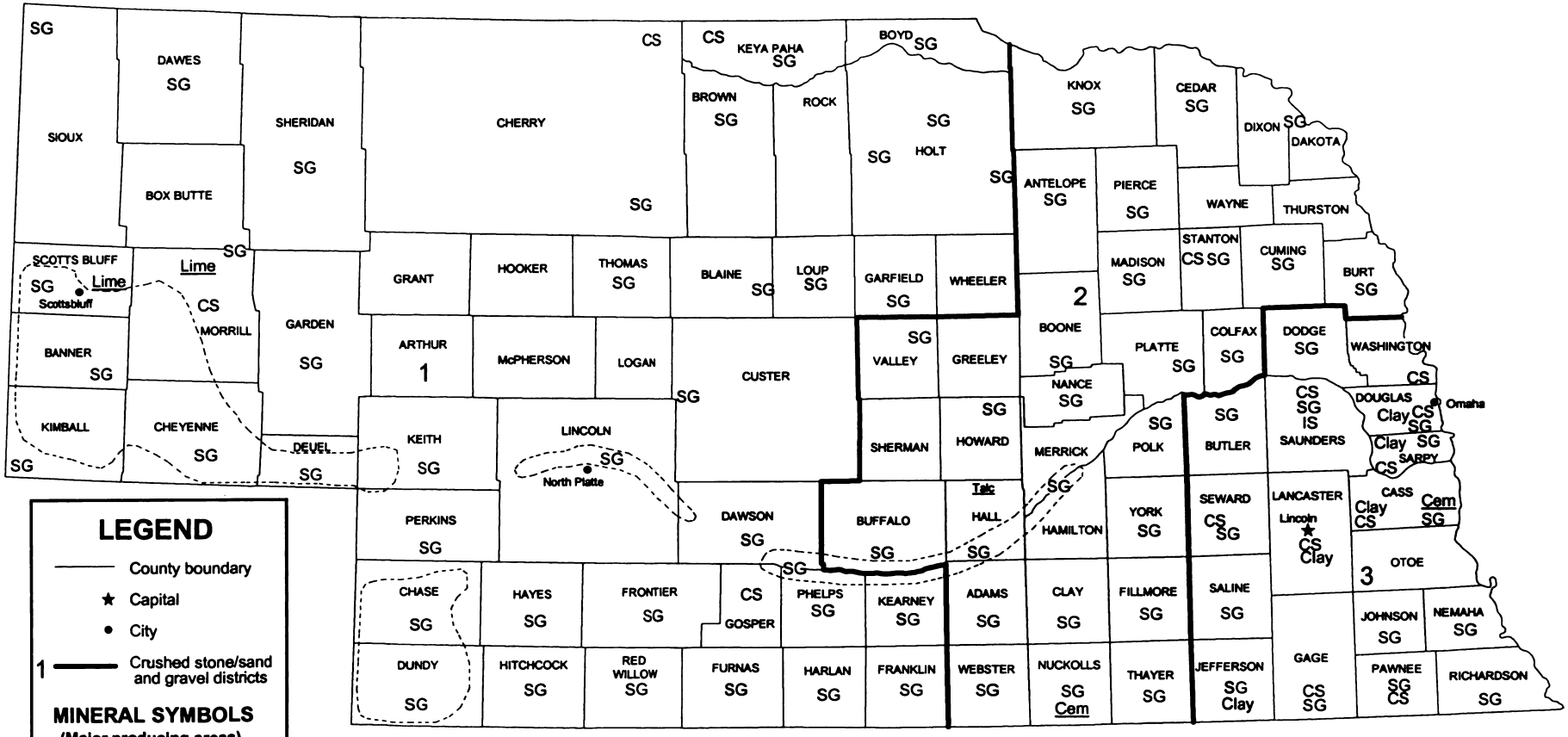
NEBRASKA



LEGEND

- County boundary
- ★ Capital
- • City
- 1 Crushed stone/sand and gravel districts

MINERAL SYMBOLS
(Major producing areas)

Cem	Cement plant
Clay	Clay
CS	Crushed stone
IS	Industrial sand
Lime	Lime plant
SG	Sand and gravel
Talc	Talc plant
	Concentration of mineral operations

CS and SG symbols often represent numerous locations within a county, and not a specific location.

0 50 Kilometers

Source: University of Nebraska-Lincoln, Nebraska Geological Survey/U.S. Geological Survey (1998)

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THE MINERAL INDUSTRY OF NEBRASKA

This chapter has been prepared under a Memorandum of Understanding between the U.S. Geological Survey and the University of Nebraska-Lincoln, Nebraska Geological Survey, for collecting information on all nonfuel minerals.

In 1998, the preliminary estimated value[1] of nonfuel mineral production for Nebraska was $174 million, according to the U.S. Geological Survey (USGS). This was more than A 5% increase from that of 1997,[2] following an 11.5% increase from 1996 to 1997. Nebraska's leading nonfuel minerals by value were portland cement, construction sand and gravel, and crushed stone, in descending order of value.

Nonfuel minerals that increased in value in 1998 included portland and masonry cement, lime, construction and industrial sand and gravel, and crushed stone. Only common clay showed a decrease and gemstones remained unchanged. Metals produced in the State, mostly raw steel, were processed from materials acquired from other domestic and foreign sources. Uranium was in situ leach mined at one location in northwestern Nebraska but it is not included in USGS statistics because it is an energy mineral.

The Nebraska Geological Survey[3] (NGS) provided the following narrative information. As reported to the NGS, Ash Grove Cement Co. reached a significant milestone in its 69-year history when, in 1998, the company shipped 907 million metric tons (1 million short tons) of portland cement from its Louisville, NE plant.

Kerford Limestone Co. started stripping a new area northwest of Weeping Water, NE. A new underground mine entrance will be developed at this site to extract limestone for crushing. Crow Butte Resources expanded its uranium mining facility near Crawford in northwestern Nebraska. Mining unit 1 started in April 1991, with first production in May 1991, and it is now in restoration. Unit 2 is also in restoration. Units 3, 4, 5, and 6 are currently in production.

A grand reopening of an old chalk mine as a tourist attraction took place July 5 in the central part of the State. Mining operations were dated from 1869 to the early 1950's. The mine was left open for picnickers and tourists until 1978 when the entrance collapsed.

Geologic mapping continued in the Omaha area as a part of the Missouri River Basin corridor project. Geologists from 10 States and the USGS continued exploring the Missouri River Basin because of three main areas of concern: the urban-rural corridor from Omaha to Kansas City, MO; issues related to mining; and the effects of agriculture. The project brings together geologists from State geological surveys in Colorado, Iowa, Kansas, Minnesota, Missouri, Montana, Nebraska, North Dakota, South Dakota, and Wyoming and the USGS. The effort will produce a large database with maps and references for finding various kinds of information about the basin, including details about geology and mineral resources.

The NGS also entered into another cooperative project with the USGS to study the geologic evolution of the Platte River. A series of test wells has been drilled and sampled by the NGS, and data from these wells will be used to illustrate the lithology, thickness, and distribution of the sediments through the use of cross-sections and thickness maps. A configuration map on top of the underlying bedrock will be used to interpret the surface of previous episodes of river drainage in this area using the same test wells.

The NGS produced several mining-related publications that were published by Nebraska's Conservation and Survey Division including 1998 updates of *Mineral Facts for Nebraska, Crow Oil and Gas Facts for Nebraska* and *Butte Uranium Deposit* (Nebraska Geonotes series), and 1998 revisions to water and mineral test-hole log books for holes drilled in Butler, Colfax, Dodge, and Washington Counties. New water and mineral test-hole log books were published for holes drilled in Harlan and Platte Counties. Information concerning these and other State geologic publications is available from the NGS.

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[1]The terms "nonfuel mineral production" and related "values" encompass variations in meaning, depending on the minerals or mineral products. Production may be measured by mine shipments, mineral commodity sales, or marketable production (including consumption by producers) as is applicable to the individual mineral commodity.

All 1998 USGS mineral production data published in this chapter are preliminary estimates as of February 1999 and are expected to change. For some mineral commodities (for example, construction sand and gravel, crushed stone, and portland cement), estimates are updated periodically. To obtain the most current information, please contact the appropriate USGS mineral commodity specialist. A telephone listing for the specialists may be retrieved over the Internet at http://minerals.usgs.gov/minerals/contacts/comdir.html; by using MINES FaxBack at (703) 648-4999 from a fax machine with a touch-tone handset (request Document #1000 for a telephone listing of all mineral commodity specialists); or by calling USGS information at (703) 648-4000 for the specialist's name and number. All Mineral Industry Surveys–mineral commodity, State, and country–also may be retrieved over the Internet at http://minerals.usgs.gov/minerals; facsimile copies may be obtained from MINES FaxBack.

[2]Values, percentage calculations, and rankings for 1997 may vary from the *Minerals Yearbook, Area Reports: Domestic 1997, Volume II*, owing to the revision of preliminary 1997 to final 1997 data. Data for 1998 are preliminary and expected to change, while related rankings may also be subject to change.

[3]Raymond R. Burchett, Professor/Research Geologist with the University of Nebraska-Lincoln and the Nebraska Geological Survey (NGS), authored the text of mineral industry information submitted by the NGS.

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TABLE 1
NONFUEL RAW MINERAL PRODUCTION IN NEBRASKA 1/ 2/

(Thousand metric tons and thousand dollars unless otherwise specified)

Mineral	1996		1997		1998 p/	
	Quantity	Value	Quantity	Value	Quantity	Value
Clays: Common	277	1,140	279	1,090	193	689
Gemstones	NA	3	NA	3	NA	3
Lime	13	1,060	17	1,360	18	1,370
Sand and gravel: Construction	12,900	44,300	13,700	46,700	14,400	50,600
Stone: Crushed	6,370	39,800	6,900	46,000	7,000	46,900
Combined values of other industrial minerals	XX	62,100	XX	70,100	XX	74,300
Total	XX	148,000	XX	165,000	XX	174,000

p/ Preliminary. NA Not available. XX Not applicable.
1/ Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
2/ Data are rounded to three significant digits; may not add to totals shown.

TABLE 2
NEBRASKA: CRUSHED STONE SOLD OR USED, BY KIND 1/

(Thousand metric tons)

Kind	1996				1997			
	Number of quarries	Quantity (thousand metric tons)	Value (thousands)	Unit value	Number of quarries	Quantity (thousand metric tons)	Value (thousands)	Unit value
Limestone	11	6,370	$39,800	$6.25	11	6,900	$46,000	$6.67

1/ Data are rounded to three significant digits.

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TABLE 3
NEBRASKA: CRUSHED STONE SOLD OR USED BY PRODUCERS IN 1997,
BY USE 1/ 2/

Use	Quantity (thousand metric tons)	Value (thousands)	Unit value
Coarse aggregate (+1 1/2 inch):			
Riprap and jetty stone	184	$1,980	$10.77
Other coarse aggregate 3/	56	357	6.38
Coarse aggregate, graded:			
Concrete aggregate, coarse	843	6,330	7.51
Other coarse aggregate 4/	259	1,890	7.31
Fine aggregate (-3/8 inch): Screening, undesignated	163	489	3.00
Coarse and fine aggregates:			
Graded road base or subbase	295	2,220	7.52
Unpaved road surfacing	292	2,360	8.07
Crusher run or fill or waste	457	3,240	7.08
Other coarse and fine aggregates	W	W	6.06
Other construction materials 5/	6	14	2.33
Agricultural:	316	2,740	8.67
Agricultural limestone	277	2,860	10.31
Other agricultural uses	(6/)	(6/)	4.52
Chemical and metallurgical:			
Cement manufacture	(6/)	(6/)	4.79
Flux stone	(6/)	(6/)	1.00
Special: Asphalt fillers or extenders	(6/)	(6/)	17.67
Other miscellaneous uses: Pipe bedding	65	391	6.02
Unspecified: Actual 7/	2,170	14,500	6.70
Total	6,900	46,000	6.67

W Withheld to avoid disclosing company proprietary data; included with "Other construction materials."
1/ Data are rounded to three significant digits, except unit value; may not add to totals shown.
2/ Includes limestone.
3/ Includes macadam.
4/ Includes bituminous aggregate (coarse) and railroad ballast.
5/ Includes other coarse and fine aggregates.
6/ Withheld to avoid disclosing company proprietary data; included in "Total."
7/ Reported production without a breakdown by end use.

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TABLE 4
NEBRASKA: CRUSHED STONE SOLD OR USED BY
PRODUCERS IN 1997, BY USE AND DISTRICT 1/ 2/

(Thousand metric tons and thousand dollars)

Use	District 3	
	Quantity	Value
Construction aggregates:		
Coarse aggregate (+1 1/2 inch) 3/	239	2,340
Coarse aggregate, graded	W	W
Fine aggregate (-3/8 inch)	W	W
Coarse and fine aggregate 4/	1,210	9,170
Other construction materials 5/	1,340	9,120
Agricultural 6/	367	3,270
Chemical and metallurgical 7/	(8/)	(8/)
Special 9/	(8/)	(8/)
Unspecified: Actual 10/	(8/)	(8/)
Total	6,900	46,000

W Withheld to avoid disclosing company proprietary data; included with "Other construction materials."
1/ Data are rounded to three significant digits; may not add to totals shown.
2/ No crushed stone was produced in District 1 and 2.
3/ Includes macadam, other coarse aggregate and riprap and jetty stone.
4/ Includes crusher run (select material or fill), graded roadbase or subbase, other combined coarse and fine aggregates, and unpaved road surfacing.
5/ Includes bituminous aggregate (coarse), concrete aggregate (coarse), railroad ballast, and screening (undesignated).
6/ Includes agricultural limestone and other agricultural uses.
7/ Includes cement manufacture and flux stone.
8/ Withheld to avoid disclosing company proprietary data; included in "Total."
9/ Includes asphalt fillers or extenders and pipe bedding.
10/ Reported production without a breakdown by end use.

TABLE 5
NEBRASKA: CONSTRUCTION SAND AND GRAVEL SOLD OR USED IN 1997,
BY MAJOR USE CATEGORY 1/

Use	Quantity (thousand metric tons)	Value (thousands)	Value per ton
Concrete aggregate (including concrete sand)	2,060	$6,420	$3.12
Plaster and gunite sands	151	464	3.07
Concrete products (blocks, bricks, pipe, decorative, etc.)	108	417	3.86
Asphaltic concrete aggregates and other bituminous	787	2,360	3.00
Road base and coverings 2/	1,980	5,960	3.01
Fill	668	1,120	1.68
Snow and ice control	64	245	3.83
Roofing granules	23	148	6.43
Other miscellaneous uses 3/	153	501	3.27
Unspecified: 4/			
Actual	1,470	5,220	3.55
Estimated	6,210	23,900	3.84
Total or average	13,700	46,700	3.42

1/ Data are rounded to three significant digits; may not add to totals shown.
2/ Includes road and other stabilization (cement).
3/ Includes filtration and railroad ballast.
4/ Reported and estimated production without a breakdown by end use.

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TABLE 6

NEBRASKA: CONSTRUCTION SAND AND GRAVEL SOLD OR USED IN 1997, BY USE AND DISTRICT 1/

(Thousand metric tons and thousand dollars)

Use	District 1		District 2		District 3		Unspecified districts	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
Concrete aggregate and concrete products 2/	478	1,250	603	1,840	1,230	4,210	--	--
Asphaltic concrete aggregates and road base materials 3/	1,070	2,590	1,280	3,750	423	1,990	--	--
Fill	116	176	269	497	283	449	--	--
Other miscellaneous uses 4/	42	127	169	524	28	242	--	--
Unspecified 5/	871	2,750	2,660	9,490	4,000	16,300	149	526
Total	2,580	6,900	4,980	16,100	5,970	23,200	149	526

1/ Data are rounded to three significant digits; may not add to totals shown.
2/ Includes plaster and gunite sands.
3/ Includes road and other stabilization (cement).
4/ Includes filtration, railroad ballast, roofing granules, and snow and ice control.
5/Reported and estimated production without a breakdown by end use.

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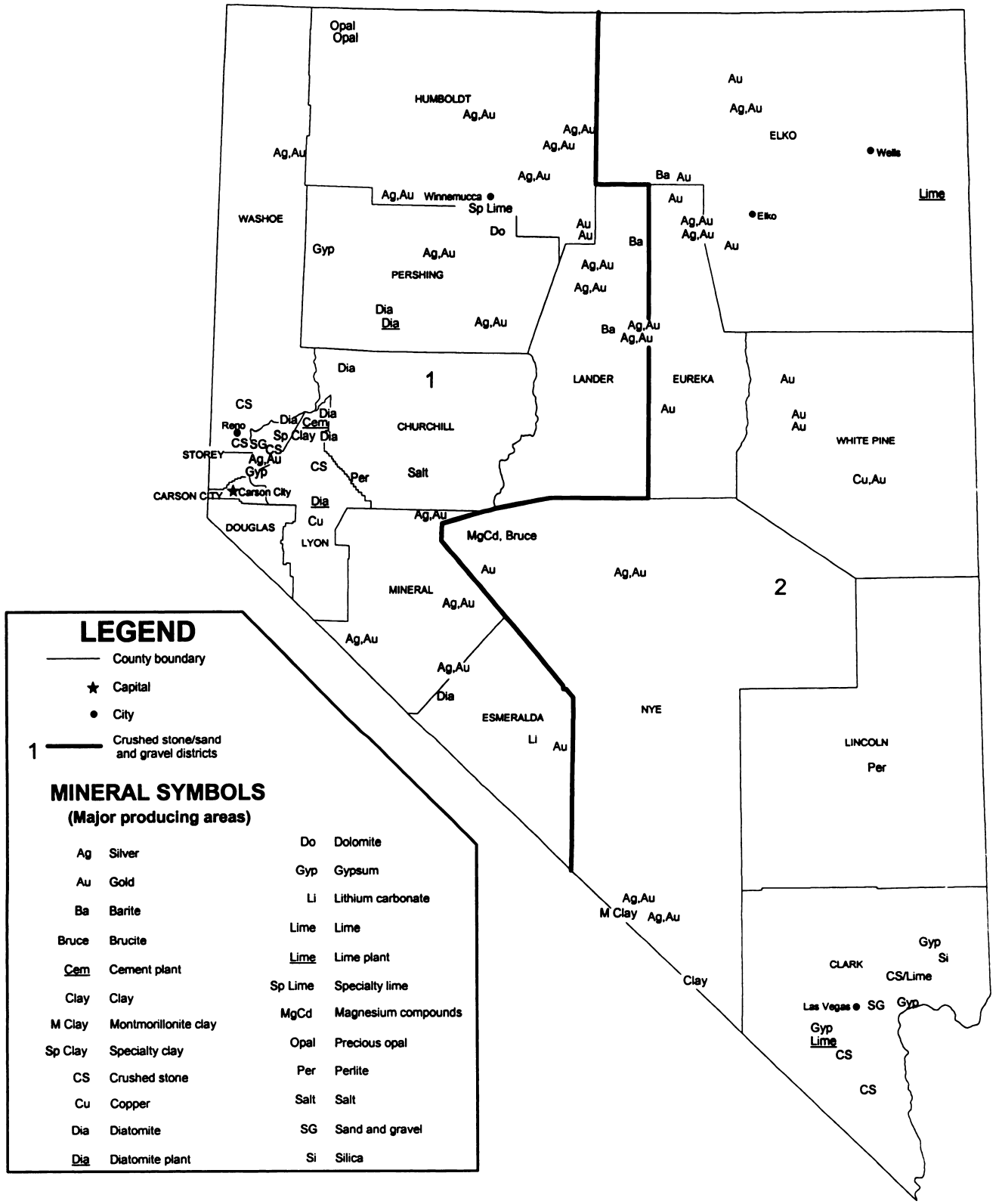
NEVADA



Source: Nevada Bureau of Mines and Geology/U.S. Geological Survey (1998)

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THE MINERAL INDUSTRY OF NEVADA

This chapter has been prepared under a Memorandum of Understanding between the U.S. Geological Survey and the Nevada Bureau of Mines and Geology for collecting information on all nonfuel minerals.

In 1998, the preliminary estimated value[1] of nonfuel mineral production for Nevada was $3.1 billion, according to the U.S. Geological Survey (USGS). This was a 5% decrease from that of 1997,[2] and followed a 0.6% increase in 1997 from 1996. The State rose in rank to first in the Nation (second in 1997) in nonfuel mineral production value, of which Nevada accounted for nearly 8% of the U.S. total.

Nevada, the Nation's leading State in gold and silver production, provided 74% and 40% of the Nation's gold and silver, respectively, and in so doing, the "Silver State" has been first in gold production since 1981 and in silver since 1987. In 1998, gold accounted for 79% of Nevada's nonfuel mineral value, but the precious metal also accounted for the largest portion of the State's decrease in value. Gold production increased, but owing to a lower average price for gold, the metal's total value decreased by about $140 million (table 1). Other nonfuel minerals that had significant decreases included copper, down about $38 million, and lithium compounds and diatomite, down $19 million and $7 million, respectively. Fuller's earth (down $3 million) showed a small, yet significant decrease. Small increases occurred for crushed stone, bentonite, crude gypsum, silver, and portland cement (descending order of magnitude of change). Copper production increased slightly, but its value decreased owing to decreased copper prices. All other nonfuel minerals showed changes of value of less than $1 million, except magnesite, which remained the same. In 1997, substantial increases in the values of copper, silver, crushed stone, and lime, supported by smaller yet significant increases in lithium compounds and diatomite were more than enough to balance out the significant decreases in gold, and combined significant drops in the values of magnesite, construction sand and gravel, and crude gypsum (descending order of change).

Based on USGS estimates of quantities produced in the 50 States during 1998, Nevada remained first[2] in gold, silver, and barite production; first of three mercury-producing States; and first of two States that produced lithium minerals; and the only State to produce magnesite. The State also retained its 1997 ranking in a number of other mineral commodities—it was second in diatomite, fourth in copper, and seventh in lime. Nevada moved up in rank to 3d from 11th in the production of gemstones (by value), and to 5th from 6th in the production of crude gypsum and crude perlite, while it dropped to 2d in brucite. In addition, significant quantities of construction sand and gravel, industrial sand and gravel, and lime were produced in the State.

According to the Fraser Institute, an economic think-tank based in Vancouver, Canada, Nevada ranked the highest in North America for overall investment attractiveness (Jones and Prager, 1998). This top ranking was a result of the State's high mineral potential rating and its number one rating in public policy in the Fraser Institute study.

The following narrative information was provided by the Nevada Bureau of Mines and Geology (NBMG).[3] Production data in the following text are those reported by the NBMG, based on its own surveys, estimates, and information gathered from company annual reports. The NBMG data are reported by that agency to be nonproprietary data and may differ from some USGS preliminary estimates and production figures as reported to the USGS.

Nevada produced 271,000 kilograms (kg) of gold in 1998 as well as 669,000 kg of silver. Nevada broke its own gold production record set in 1997, and for the first time exceeded the 249,000 kg mark. Silver production, however, was down from the record set in 1997. Nevada remained the leading gold- and silver-producing State in the United States with 36 mines reporting gold production and 30 mines producing silver production during 1998.

Newmont Mining Corp. continued as the largest gold-producing company in Nevada with 84,107 kg of gold produced in 1998 from its operations, which include Twin Creeks and the Lone Tree Complex as well as all of the company's Carlin Trend mines. Newmont's gold production was down slightly from the 1997 figure of 86,359 kg.

Barrick Gold Corp. was second in Nevada gold production, with 72,969 kg, and for the fourth consecutive year, Barrick's Betze-Post Mine was the largest individual Nevada gold producer with 46,614 kg. This figure was lower than the 1997 Betze-Post production of 49,947 kg, but Barrick Gold's Meikle Mine reported 1998 production of 26,354 kg, up from the 1997 figure of 17,863 kg. Other major gold producers in 1998 included Smoky Valley Common Operation's Round Mountain Mine with 15,878 kg. Placer Dome's Cortez Gold

[1]The terms "nonfuel mineral production" and related "values" encompass variations in meaning, depending on the minerals or mineral products. Production may be measured by mine shipments, mineral commodity sales, or marketable production (including consumption by producers) as is applicable to the individual mineral commodity.

All 1998 USGS mineral production data published in this chapter are preliminary estimates as of February 1999 and are expected to change. For some mineral commodities (for example, construction sand and gravel, crushed stone, and portland cement), estimates are updated periodically. To obtain the most current information, please contact the appropriate USGS mineral commodity specialist. A telephone listing for the specialists may be retrieved over the Internet at http://minerals.usgs.gov/minerals/contacts/comdir.html; by using MINES FaxBack at (703) 648-4999 from a fax machine with a touch-tone handset (request Document #1000 for a telephone listing of all mineral commodity specialists); or by calling USGS information at (703) 648-4000 for the specialist's name and number. All Mineral Industry Surveys—mineral commodity, State, and country—also may be retrieved over the Internet at http://minerals.usgs.gov/minerals; facsimile copies may be obtained from MINES FaxBack.

[2]Values, percentage calculations, and rankings for 1997 may vary from the *Minerals Yearbook, Area Reports: Domestic 1997, Volume II*, owing to the revision of preliminary 1997 to final 1997 data. Data for 1998 are preliminary and expected to change, while related rankings may also be subject to change.

[3]Joseph V. Tingley and Daphne D. La Pointe, Research Geologists, co-authored the text of mineral industry information provided by the Nevada Bureau of Mines and Geology.

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Mines (including Pipeline) produced 35,500 kg; Independence Mining Co.'s Jerritt Canyon Mine produced 10,800 kg. Echo Bay Minerals Co. produced 5,210 kg from its McCoy/Cove operation, and Getchell Gold's Getchell Mine produced 5,453 kg.

Echo Bay Minerals' McCoy/Cove operation was Nevada's largest silver producer in 1998, yielding 292,000 kg. Coeur d'Alene Mines' Rochester Mine produced 224,000 kg of silver, and Kinross' Candelaria Mine produced 34,000 kg of silver. Other large silver-producing operations included Kennecott Rawhide Mining Co.'s Denton Rawhide Mine with 26,400 kg, Round Mountain Mine with 15,904 kg, and Hecla Mining's Rosebud Mine, which produced 14,866 kg.

BHP Copper Co. continued to operate its Robinson Copper Mine during 1998, producing 67,313 metric tons (t) of copper in concentrate, along with 2,700 kg of gold and 9,316 kg of silver. The MacArthur copper mine in Lyon County did not produce in 1998, while the Yerington Mine produced from stockpiled ore.

At an estimated $373 million, the total value of industrial minerals produced in Nevada in 1998 was slightly above that for 1997. The most important Nevada industrial minerals produced in 1998, in order of estimated dollar value, were aggregates, lime, diatomite, gypsum, cement, barite, lithium, silica, clay, and magnesia. Data used for these estimates, and data reported for individual commodities below, were obtained from the NBMG or directly from companies that produced industrial minerals.

In 1998, construction aggregates (sand, gravel, and crushed stone) production in Nevada had an approximate total value of $119 million and was ranked second among the State's mined commodities behind gold. For 1998, statewide aggregates production was estimated at 24.0 million metric tons (Mt), 5% below production in 1997. Aggregates produced from sand and gravel deposits accounted for about 75% of aggregates production statewide, with crushed stone and lightweight aggregates making up the balance.

Companies in the Las Vegas area that produced more than 1 million ton of aggregates in 1997, ranked in order of tonnage produced, were Nevada Ready Mix Corp., Hanson Aggregates West (formerly Bonanza Materials Inc.), CSR (formerly WMK Transit Mix Inc.), Frehner Construction Inc; Wells Cargo Inc., and Blue Diamond Materials Co. The largest producer, Nevada Ready Mix Co., produced most of its aggregates from a single open pit in an alluvial fan in the Lone Mountain area. Community pits and other aggregates mining facilities administered by the U.S. Bureau of Land Management and operated at least seven different companies, provided about 2.1 Mt to the Las Vegas area total in 1998.

In 1998, sand and gravel operations accounted for about 85% of aggregates used in the Las Vegas metropolitan area, with crushed stone and lightweight aggregate making up the balance. Major crushed stone producers in the Las Vegas area were Frehner Construction Co., Lopke Granite Products, and Southern Nevada Lightweight.

As in the past 7 years, the most important source of Las Vegas area aggregates was the Lone Mountain area northwest of Las Vegas. Once located a considerable distance from heavily urbanized areas, the impact of Lone Mountain aggregates operations, particularly on residential traffic, is now coming under scrutiny due to encroaching urbanization. Significant production still comes from sites located in more heavily urbanized parts of the Las Vegas metropolitan area, but it is likely that future production will come increasingly from more distant sources. Since 1997, common aggregates have been hauled into Las Vegas from sites as far as 80 kilometers (km) away in Lincoln County.

In the Reno-Sparks-Carson City area, Granite Construction Co. and All-Lite Aggregate Co. produced about 1 million ton of aggregates in 1998. Companies that produced 450,000 t or more in 1998 included Rocky Ridge Inc. and Rilite Aggregate Co. Paiute Pit Aggregates, 48 km east of the Reno-Sparks metropolitan area, was also a major producer. Crushed rock continued to be an important source of aggregates in this area; crushed rock operations of Granite Construction and Rocky Ridge and lightweight rhyolite aggregates from All-Lite Aggregate Co., Rilite Aggregate Co., and Basqlite Lightweight Aggregate Corp. accounted for about 70% of the aggregate used in 1998 in the Reno-Sparks-Carson City area.

In 1998, barite shipments from Nevada totaled 445,000 t, 16% less than in 1997. M.I. Drilling Fluids Co. was once again the largest Nevada barite producer, with combined production of nearly 272,000 t of screened and crushed high-grade ore from the Greystone Mine and ground and bagged barite from its Battle Mountain plant, both in Lander County. In 1998 likely acquisition of Dresser Industries, Inc., the parent company of M.I. Drilling Fluids, by Halliburton Inc. was announced. If this takes place, the two largest barite producers in Nevada would be part of a single company.

Baroid Drilling Fluids, a subsidiary of Halliburton, shipped barite from the Dunphy Mill in Eureka County and the Rossi Mine in Elko County in 1998. Milpark Inc. also produced significant amounts of barite for drilling materials at its Argenta property near Battle Mountain, Lander County. Standard Industrial Minerals Inc. shipped a small amount of barite in 1998 from the P and S Mine in Nye County to a processing plant in Bishop, CA. The company markets high value white paint-grade barite for use in paint and as a filler.

American Borate Co. mined borate minerals from an underground operation in Death Valley, CA, in 1998. The ore is processed at the Lathrop Wells Mill in Nye County, but because the ore is from out of State, this production is not included in the estimate of total value of Nevada minerals.

Although the company mainly produces crushed landscape rock, Las Vegas Rock produced some sandstone building stone at Goodsprings, Clark County. Nevada Neanderthal Stone, which quarries and cuts Tertiary tuff near Beatty in Nye County for floor tile and other stone products, has seen its sales decline to 20% of former levels due to competition from foreign competitors.

The Nevada Cement Co., a subsidiary of Centex Construction Products, Inc., produces portland cement at a plant at Fernley in Lyon County. Annual production exceeds 450,000 t of cement. The Royal Cement Co. owns an idle plant near Logandale in Clark County. Annual production from this plant between 1995 and 1997 was as much as 45,000 t of cement. The plant is now shut down and there is no indication that the plant will resume production.

Clay production in Nevada in 1998 declined somewhat from 1997. IMV Nevada, which is owned by Mud Camp Mining Co. of California, is the largest producer. The operation consists of sepiolite, montmorillonite, and saponite mines and

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a processing plant in Amargosa Valley, Nye County. The company is the only producer of sepiolite and saponite in the United States, and exports clay mineral products with a variety of uses worldwide.

Eagle-Picher Minerals, Inc., a division of Eagle-Picher Industries, Inc., produces most of Nevada's diatomite at three different operations. The largest operation is the Colado plant near Lovelock in Pershing County, which produces diatomaceous earth filtration products from diatomite mined northwest of Lovelock. The company also produced diatomite that is mainly used in fillers and absorbents at its Clark plant and mine in Storey County, and diatomite used in insulation from a pit near Hazen in Lyon County.

Moltan Co. of Memphis, TN, is the second largest diatomite miner in Nevada, producing cat litter, oil absorbent, and soil conditioner from diatomite mined in Churchill County northeast of Fernley. Other companies that produced diatomite in Nevada in 1998 were Grefco Inc. at its Basalt operation in Esmeralda and Mineral Counties, and CR Minerals Corp. at Hazen in Lyon County.

Gypsum production in Nevada increased from 1.5 Mt in 1997 to 1.6 Mt in 1998. The Blue Diamond operation of James Hardie Gypsum Co., just southwest of Las Vegas in Clark County, was the largest producer at more than 680,000 t. This gypsum was used to make wallboard and plaster. USG Corp., which mines gypsum at the other end of the State (northern Pershing County) was the second largest producer at nearly 476,000 t. USG processes the gypsum into wallboard and plaster at its Empire plant in northern Washoe County. Although PABCO Gypsum in Clark County east of Las Vegas mined nearly 530,000 t of ore in 1996, actual gypsum production was lower because the ore must be beneficiated to produce a gypsum concentrate. PABCO processes most of this gypsum into wallboard. The Art Wilson Co., Carson City, shipped about 104,000 t of gypsum from the Adams Mine in Lyon County for use in cement and agricultural markets.

In 1998, lime production in Nevada continued at record levels, increasing 7% over 1997. The Continental Lime, Inc. Pilot Peak high-calcium lime operation near Wendover in Elko County shipped the most lime in 1998, mainly to Nevada gold mining operations for use in pH control. Chemical Lime Co. produced high-calcium and dolomitic lime at Apex near Las Vegas. Hydrated lime is made from Apex quicklime at a plant in Henderson. The high-calcium lime is mainly used for gold mine processing, paper manufacturing, and environmental markets; the dolomitic lime is mostly used in construction. In late 1997, Chemical Lime shut down its dolomite mining operation at Sloan, south of Las Vegas, where limestone and dolomite had been mined since 1910.

In addition to lime, Chemical Lime shipped crushed limestone for glass flux and flue gas desulfurization. Other carbonate rock producers in Nevada were Min-Ad, Inc. and Nutritional Additives Corp., which are both located near Winnemucca, produce ground dolomite for agricultural use. Min-Ad, the largest of the two agricultural dolomite producers, shipped more than 54,000 t in 1998, a slight increase over 1997.

In October 1998, the Silver Peak, Esmeralda County, lithium operation was sold to Chemetall GmbH, a subsidiary of the giant Metallgesellschaft AG, for $305 million by Cyprus Amax Minerals Co. The operation, which produces lithium carbonate and lithium hydroxide compounds from brine that is pumped from beneath Clayton Valley playa and evaporated in nearby ponds, has been active since 1965. A similar lithium brine facility in Chile was included in the sale. In recent years, Cyprus Amax earnings from lithium sales have been strong and prices high; however, the new SQM Chemicals S.A. (formerly Minsal) lithium brine operation in South America caused price reductions in 1998.

Annual production of magnesia from magnesite at Gabbs, Nye County, by Premier Services Corp. was approximately the same in 1998 as in 1997. Brucite (magnesium hydroxide) production was up sharply, though still relatively small in comparison to past brucite production from the deposit.

In 1998, Eagle-Picher Minerals produced expanded perlite at the Colado diatomaceous earth facility in Pershing County from perlite that is mined in Churchill County. In addition, the Wilkin Mining and Trucking Co. mined perlite from the Mackie Mine in Lincoln County.

The Huck Salt Co. of Fallon produced about 16,000 t of salt in 1998. The salt, mined from Fourmile Flat near the Sand Springs mining district in Churchill County, is now mainly used for deicing roads. Salt has been harvested from this playa deposit more-or-less continuously since salt was hauled to Virginia City for ore processing in the 1860's.

The Simplot Silica Products plant at Overton in Clark County shipped 580,000 t of silica sand in 1998, the same as in 1997. The sand is mined from a large deposit of friable sandstone, washed in the pit, and transported via a slurry pipeline to the plant where it is screened and bagged.

The American Resource Corp. processing plant near Amargosa Valley, Nye County, shipped clinoptilolite for water processing, odor control, and horticultural uses in 1998. The company was placed in receivership along with its parent company, Rea Gold Corp., in March 1998. An offer to buy the zeolite operation by Badger Mining Corp., a Wisconsin-based industrial mineral company, was accepted in 1998. It is anticipated that the acquisition will be finalized in 1999. The clinoptilolite deposit extends from California, where it is presently mined, into Nevada. The operation has plans for plant expansion and development of a mine in Nevada.

American Colloid Inc. sold the Eastgate plant in Churchill County to an unnamed buyer. The plant, which was acquired from American Resource Corp. in 1995, was originally constructed by East West Minerals Inc. in 1987 to process mordenite into cat litter and absorbent products.

Metals exploration continued in Nevada in 1998 although at a lower level than in 1997. As in the recent past, 1998 exploration activity was concentrated along the major trends in the northern part of the State, the Battle Mountain-Eureka, Carlin, Getchell, and Midas trends. Several projects were pursued in Mineral, Esmeralda, and western Nye Counties along the Walker Lane, but no new activity was reported in Lincoln or Clark Counties, or along the eastern borderlands of the State.

Reference Cited

Jones, Laura, and Prager, Sharon, 1998, The Fraser Institute survey of mining companies operating in North America-1998/99: Vancouver, Canada, Fraser Institute, 50 p.

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TABLE 1
NONFUEL RAW MINERAL PRODUCTION IN NEVADA 1/ 2/

(Thousand metric tons and thousand dollars unless otherwise specified)

Mineral		1996 Quantity	1996 Value	1997 Quantity	1997 Value	1998 p/ Quantity	1998 p/ Value
Clays:							
Bentonite		6	580	W	W	W	W
Kaolin		25	W	W	W	W	W
Gemstones		NA	234	NA	474	NA	1,520
Gold 3/	kilograms	215,000	2,700,000	243,000	2,600,000	259,000	2,460,000
Sand and gravel: Construction		22,400	113,000	23,600	110,000	25,200	121,000
Silver 3/	metric tons	594	99,100	866	136,000	845	139,000
Stone: Crushed		3,080	25,200	5,150	41,800	5,600	46,200
Zeolites	metric tons	(4/)	NA	(4/)	NA	NA	NA
Combined values of barite, brucite, cement (portland), clays (fuller's earth), copper, diatomite, gypsum (crude), lime, lithium minerals, magnesite, mercury, perlite (crude), salt, sand and gravel (industrial), and values indicated by symbol W		XX	315,000	XX	383,000	XX	324,000
Total		XX	3,250,000	XX	3,270,000	XX	3,100,000

P/ Preliminary. NA Not available. W Withheld to avoid disclosing company proprietary data; value included with "Combined values" data. XX Not applicable.
1/ Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
2/ Data are rounded to three significant digits; may not add to totals shown.
3/ Recoverable content from ores, etc.
4/ Withheld to avoid disclosing company proprietary data.

TABLE 2
NEVADA: CRUSHED STONE SOLD OR USED, BY KIND 1/

Kind	1996 Number of quarries	1996 Quantity (thousand metric tons)	1996 Value (thousands)	1996 Unit value	1997 Number of quarries	1997 Quantity (thousand metric tons)	1997 Value (thousands)	1997 Unit value
Limestone	8	2,170	$15,600	$7.17	8	3,890	$28,700	$7.38
Dolomite	3	W	W	14.70	3	W	W	14.70
Granite	1	W	W	12.51	1	W	W	15.93
Traprock	6	W	W	3.30	6	W	W	3.48
Volcanic cinder and scoria	1	W	W	2.20	1	W	W	4.04
Miscellaneous stone	1	W	W	4.41	1	W	W	8.27
Total	XX	3,080	25,200	8.18	XX	5,150	41,800	8.12

W Withheld to avoid disclosing company proprietary data; included in "Total." XX Not applicable.
1/ Data are rounded to three significant digits, except unit value; may not add to totals shown.

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TABLE 3
NEVADA: CRUSHED STONE SOLD OR USED BY PRODUCERS
IN 1997, BY USE 1/ 2/

Use	Quantity (thousand metric tons)	Value (thousands)	Unit value
Coarse aggregate (+1 1/2 inch): Other coarse aggregate 3/	75	$808	$10.77
Coarse aggregate, graded:			
Concrete aggregate, coarse	605	6,910	11.42
Bituminous aggregate, coarse	73	440	6.03
Other graded coarse aggregate	4	59	14.75
Fine aggregate (-1/8 inch):			
Stone sand, bituminous mix or seal	64	385	6.02
Other fine aggregate 4/	140	1,270	9.05
Coarse and fine aggregates:			
Graded road base or subbase	408	1,740	4.26
Crusher run or fill or waste	54	150	2.78
Other construction materials 5/	477	3,650	7.65
Agricultural:			
Poultry grit and mineral food	54	1,780	32.91
Other agricultural uses	W	W	11.02
Chemical and metallurgical:			
Cement manufacture	W	W	4.37
Lime manufacture	W	W	9.38
Flux stone	W	W	16.36
Sulfur oxide removal	W	W	3.49
Other miscellaneous uses: Waste material	W	W	1.10
Unspecified: 6/			
Actual	489	4,150	8.49
Estimated	15	65	4.33
Total	5,150	41,800	8.12

W Withheld to avoid disclosing company proprietary data; included in "Total."
1/ Data are rounded to three significant digits, except unit value; may not add to totals shown.
2/ Includes dolomite, granite, limestone, miscellaneous stone, traprock, and volcanic cinder and scoria.
3/ Includes riprap and jetty stone.
4/ Includes stone sand (concrete) and screening (undesignated).
5/ Includes unpaved road surfacing.
6/ Reported and estimated production without a breakdown by end use.

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TABLE 4
NEVADA: CRUSHED STONE SOLD OR USED BY PRODUCERS IN 1997,
BY USE AND DISTRICT 1/

(Thousand metric tons and thousand dollars)

Use	District 1		District 2	
	Quantity	Value	Quantity	Value
Construction aggregates:				
Coarse aggregate (+1 1/2 inch) 2/	W	W	W	W
Coarse aggregate, graded 3/	W	W	W	W
Fine aggregate (-3/8 inch) 4/	W	W	W	W
Coarse and fine aggregate 5/	402	1,720	W	W
Other construction materials 6/	W	W	W	W
Agricultural 7/	W	W	--	--
Chemical and metallurgical 8/	W	W	W	W
Unspecified 9/				
Actual	W	W	W	W
Estimated	--	--	15	65
Total	2,270	14,900	2,880	26,900

W Withheld to avoid disclosing company proprietary data; included in "Total."
1/ Data are rounded to three significant digits; may not add to totals shown.
2/ Includes riprap and jetty stone.
3/ Includes concrete aggregate (coarse), bituminous aggregate (coarse), and other coarse aggregate.
4/ Includes stone sand (concrete), stone sand (bituminous mix or seal), and screening (undesignated).
5/ Includes graded road base or subbase, unpaved road surfacing, crusher run (select material or fill), and other coarse and fine aggregates.
6/ Includes waste material.
7/ Includes poultry grit and mineral food and other agricultural uses.
8/ Includes cement manufacture, flux stone, lime manufacture, and sulfur oxide removal.
9/ Includes reported and estimated production without a breakdown by end use.

TABLE 5
NEVADA: CONSTRUCTION SAND AND GRAVEL SOLD OR USED IN 1997,
BY MAJOR USE CATEGORY 1/

Use	Quantity (thousand metric tons)	Value (thousands)	Value per ton
Concrete aggregate (including concrete sand)	3,600	$21,600	$6.02
Plaster and gunite sands	530	2,220	4.20
Concrete products (blocks, bricks, pipe, decorative, etc.)	278	1,200	4.32
Asphaltic concrete aggregates and other bituminous mixtures	2,080	11,100	5.36
Road base and coverings 2/	3,670	14,300	3.90
Fill	1,260	4,340	3.43
Snow and ice control	67	294	4.39
Other miscellaneous uses 3/	1,450	6,660	4.59
Unspecified: 4/			
Actual	5,830	30,800	5.29
Estimated	4,810	17,700	3.68
Total or average	23,600	110,000	4.66

1/ Data are rounded to three significant digits; may not add to totals shown.
2/ Includes road and other stabilization (cement).
3/ Includes filtration and railroad ballast.
4/ Includes reported and estimated production without a breakdown by end use.

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TABLE 6

NEVADA: CONSTRUCTION SAND AND GRAVEL SOLD OR USED IN 1997,

BY USE AND DISTRICT 1/

(Thousand metric tons and thousand dollars)

Use	District 1		District 2		Unspecified districts	
	Quantity	Value	Quantity	Value	Quantity	Value
Concrete aggregate and concrete products 2/	915	4,490	3,490	20,600	--	--
Asphaltic concrete aggregates	1,040	6,530	876	4,230	161	365
Road base and coverings 3/	863	3,570	2,730	10,600	76	172
Fill	590	2,580	674	1,760	--	--
Other miscellaneous uses 4/	32	325	1,490	6,630	--	--
Unspecified: 5/						
Actual	5	9	5,700	30,600	125	207
Estimated	1,470	5,520	3,330	12,200	--	--
Total	4,920	23,000	18,300	86,500	362	744

1/ Data are rounded to three significant digits; may not add to totals shown.

2/ Includes plaster and gunite sands.

3/ Includes road and other stabilization (cement).

4/ Includes filtration, railroad ballast, and snow and ice control.

5/ Includes reported and estimated production without a breakdown by end use.

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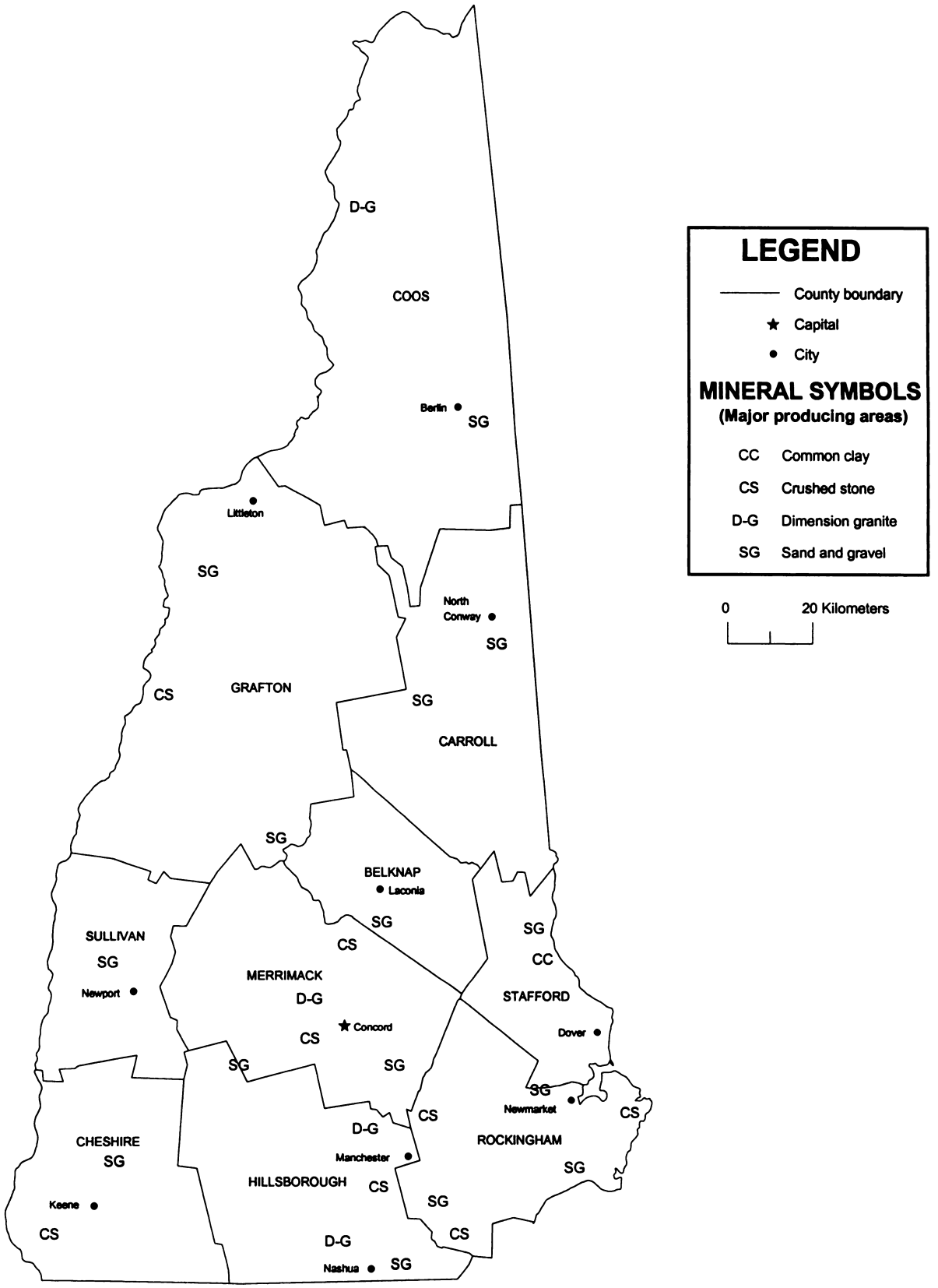
NEW HAMPSHIRE



Source: New Hampshire Department of Environmental Services/U.S. Geological Survey (1998)

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THE MINERAL INDUSTRY OF NEW HAMPSHIRE

This chapter has been prepared under a Memorandum of Understanding between the U.S. Geological Survey and the New Hampshire Department of Environmental Services for collecting information on all nonfuel minerals.

In 1998, the preliminary estimated value[1] of nonfuel mineral production for New Hampshire was about $53 million, according to the U.S. Geological Survey (USGS). This was a 9% increase from that of 1997.[2] Because data for crushed limestone, sandstone, and dimension granite have been withheld to avoid disclosing company proprietary data, the actual total values for 1997 and 1998 are higher than those reported in table 1. The State's total nonfuel mineral production value increased in 1997 and 1998.

Construction sand and gravel, a high-volume, low-value mineral commodity, was New Hampshire's leading nonfuel mineral commodity, accounting for about 73% of its apparent nonfuel mineral value. Crushed stone was the State's second leading nonfuel mineral. In 1998, the increases in the values of both mineral commodities combined to account for virtually all of New Hampshire's increase in value. Although production of dimension granite only decreased by about 4%, a 40% drop in its value somewhat mitigated the year's overall gain. In 1997, crushed stone led the State's mineral commodities with more than a $3.6 million increase; dimension granite also increased, while all other commodities remained unchanged.

A variety of geologic maps, as well as publications related to New Hampshire's nonfuel mineral resources and markets, are available for purchase from the State government. Two geologic maps of New Hampshire were recently made available over the Internet: *a Generalized Bedrock Geologic Map of New Hampshire* and a *Simplified Bedrock Geologic Map of New Hampshire*. These maps were adapted from the full-size original 1997 edition of *Bedrock Geology Map of New Hampshire*, Geologic Map GEO-1, which was produced as a joint project and in cooperation with the USGS. Several surficial geologic maps were published in 1997 as open file reports (OFR): a map of the Mount Pawtuckaway quadrangle, Rockingham County, NH: NH Geologic Survey OFR-97-1, and a second map of the Penacook quadrangle, Rockingham County, NH: NH Geological Survey, OFR-97-2. Additionally, a series of peat resource maps is available.

New Hampshire mineral publications that are available are as follows: *Construction aggregate resources of New England: An analysis of supply and demand: Boston, MA*, New England Governors' Conference, Inc., 1995 (both full report and executive summary); *New Hampshire sand and gravel resources: Boston, MA*, New England Governors' Conference, Inc., 1993, including three map sheets, scale 1:250,000; *Construction aggregate demand in the New England States: Boston, MA*, New England Governors' Conference, Inc., 1992; and *Bibliography and Index of New Hampshire Geology* (selected from publications indexed in GeoRef data base by American Geologic Institute), New Hampshire Department of Environmental Services, Geological Survey, 1991.

Information regarding the cost and ordering procedures for any of these publications may be obtained through the Office of the State Geologist or over the Internet at http://www.state.nh.us/des/geo1link.htm.

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[1]The terms "nonfuel mineral production" and related "values" encompass variations in meaning, depending on the minerals or mineral products. Production may be measured by mine shipments, mineral commodity sales, or marketable production (including consumption by producers) as is applicable to the individual mineral commodity.

All 1998 USGS mineral production data published in this chapter are preliminary estimates as of February 1999 and are expected to change. Construction sand and gravel and crushed stone estimates are updated periodically. To obtain the most current information, please contact the appropriate USGS mineral commodity specialist. A telephone listing for the specialists may be retrieved over the Internet at http://minerals.usgs.gov/minerals/contacts/comdir.html; by using MINES FaxBack at (703) 648-4999 from a fax machine with a touch-tone handset (request Document #1000 for a telephone listing of all mineral commodity specialists); or by calling USGS information at (703) 648-4000 for the specialist's name and number. All Mineral Industry Surveys–mineral commodity, State, and country–also may be retrieved over the Internet at http://minerals.usgs.gov/minerals; facsimile copies may be obtained from MINES FaxBack.

[2]Values, percentage calculations, and rankings for 1997 may vary from the *Minerals Yearbook, Area Reports: Domestic 1997, Volume II*, owing to the revision of preliminary 1997 to final 1997 data. Data for 1998 are preliminary and expected to change, while related rankings may also be subject to change.

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TABLE 1
NONFUEL RAW MINERAL PRODUCTION IN NEW HAMPSHIRE 1/ 2/

(Thousand metric tons and thousand dollars unless otherwise specified)

Mineral		1996 Quantity	1996 Value	1997 Quantity	1997 Value	1998 p/ Quantity	1998 p/ Value
Clays: Common		3	16	--	--	--	--
Gemstones		NA	6	NA	6	NA	6
Sand and gravel: Construction		7,620	36,500	8,440	36,400	8,780	39,000
Stone:							
Crushed 3/		1,430	8,650	1,970	12,300	2,200	14,100
Dimension	metric tons	29,000	6,500	W	W	W	W
Total 4/		XX	51,700	XX	48,700	XX	53,100

p/ Preliminary. NA Not available. W Withheld to avoid disclosing company proprietary data. XX Not applicable.
1/ Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
2/ Data are rounded to three significant digits; may not add to totals shown.
3/ Excludes certain stones, values which must be concealed to avoid disclosing company proprietary data.
4/ Partial total, excludes values which must be concealed to avoid disclosing company proprietary data.

TABLE 2
NEW HAMPSHIRE: CRUSHED STONE SOLD OR USED, BY KIND 1/

Kind	1996 Number of quarries	1996 Quantity (thousand metric tons)	1996 Value (thousands)	1996 Unit value	1997 Number of quarries	1997 Quantity (thousand metric tons)	1997 Value (thousands)	1997 Unit value
Granite	2 r/	W	W	W	3	W	W	W
Limestone	1	(2/)	(2/)	(2/)	1	(2/)	(2/)	(2/)
Sandstone	1	(2/)	(2/)	(2/)	1	(2/)	(2/)	(2/)
Traprock	8	W	W	W	9	W	W	W
Total	XX	1,430	8,650	6.06	XX	1,970	12,300	6.23

r/ Revised. W Withheld to avoid disclosing company proprietary data; included in "Total." XX Not applicable.
1/ Data are rounded to three significant digits; may not add to totals shown.
2/ Excluded from State total to avoid disclosing company proprietary data.

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TABLE 3

NEW HAMPSHIRE: CRUSHED STONE SOLD OR USED BY PRODUCERS IN 1997, BY USE 1/ 2/

Use	Quantity (thousand metric tons)	Value (thousands)	Unit value
Coarse aggregate (+1 1/2 inch):			
Riprap and jetty stone	17	$106	$6.24
Other coarse aggregates 3/	110	678	6.16
Coarse aggregates graded:			
Concrete aggregate, coarse	115	863	7.50
Bituminous aggregate, coarse	256	1,690	6.61
Other graded coarse aggregate	844	5,720	6.78
Fine aggregate (-3/8 inch): Other fine aggregates 4/	238	1,380	5.82
Coarse and fine aggregates:			
Graded road base or subbase	82	379	4.62
Other coarse and fine aggregates 5/	168	800	4.76
Unspecified: 6/			
Actual	W	W	W
Estimated	W	W	W
Total	1,970	12,300	6.23

W Withheld to avoid disclosing company proprietary data; included in "Total."
1/ Includes granite and traprock; excludes limestone from State total to avoid disclosing company proprietary data.
2/ Data are rounded to three significant digits; may not add to totals shown.
3/ Includes macadam and filter stone.
4/ Includes stone sand (concrete), stone sand (bituminous mix or seal), and screening (undesignated).
5/ Includes crusher run (select material or fill) and unpaved road surfacing.
6/ Includes reported and estimated production without a breakdown by end use.

TABLE 4
NEW HAMPSHIRE: CRUSHED STONE SOLD OR USED BY PRODUCERS IN 1997, BY USE AND DISTRICT 1/

(Thousand metric tons and thousand dollars)

Use	District 1	
	Quantity	Value
Construction aggregates:		
Coarse aggregate (+1 1/2 inch) 2/	W	W
Coarse aggregate, graded 3/	1,160	7,890
Fine aggregate (-3/8 inch) 4/	149	741
Coarse and fine aggregate 5/	182	843
Unspecified 6/	2,150	14,000
Actual	W	W
Estimated	W	W
Total	1,970	12,300

W Withheld to avoid disclosing company proprietary data; included in "Total."
1/ Data are rounded to three significant digits; may not add to totals shown.
2/ Includes filter stone, macadam, other coarse aggregate, and riprap and jetty stone.
3/ Includes concrete aggregate (coarse), bituminous aggregate (coarse), and other coarse aggregate.
4/ Includes stone sand (concrete), stone sand (bituminous mix or seal), screening (undesignated), and other fine aggregate.
5/ Includes crusher run (select material or fill), graded roadbase or subbase, unpaved road surfacing.
6/ Includes reported and estimated production without a breakdown by end use.

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TABLE 5
NEW HAMPSHIRE: CONSTRUCTION SAND AND GRAVEL SOLD OR USED IN 1997,
BY MAJOR USE CATEGORY 1/

Use	Quantity (thousand metric tons)	Value (thousands)	Value per ton
Concrete aggregate and concrete products 2/	2,040	$11,300	$5.52
Asphaltic concrete aggregates and other bituminous mixtures	337	1,840	5.47
Road base and coverings	838	4,110	4.91
Fill	2,070	4,170	2.02
Snow and ice control	149	606	4.07
Railroad ballast	34	267	7.85
Other miscellaneous uses 3/	284	1,120	3.93
Unspecified: 4/			
Actual	1,350	6,320	4.68
Estimated	1,340	6,670	4.99
Total or average	8,440	36,400	4.79

1/ Data are rounded to three significant digits; may not add to totals shown.
2/ Includes plaster and gunite sands.
3/ Includes filtration.
4/ Includes reported and estimated production without a breakdown by end use.

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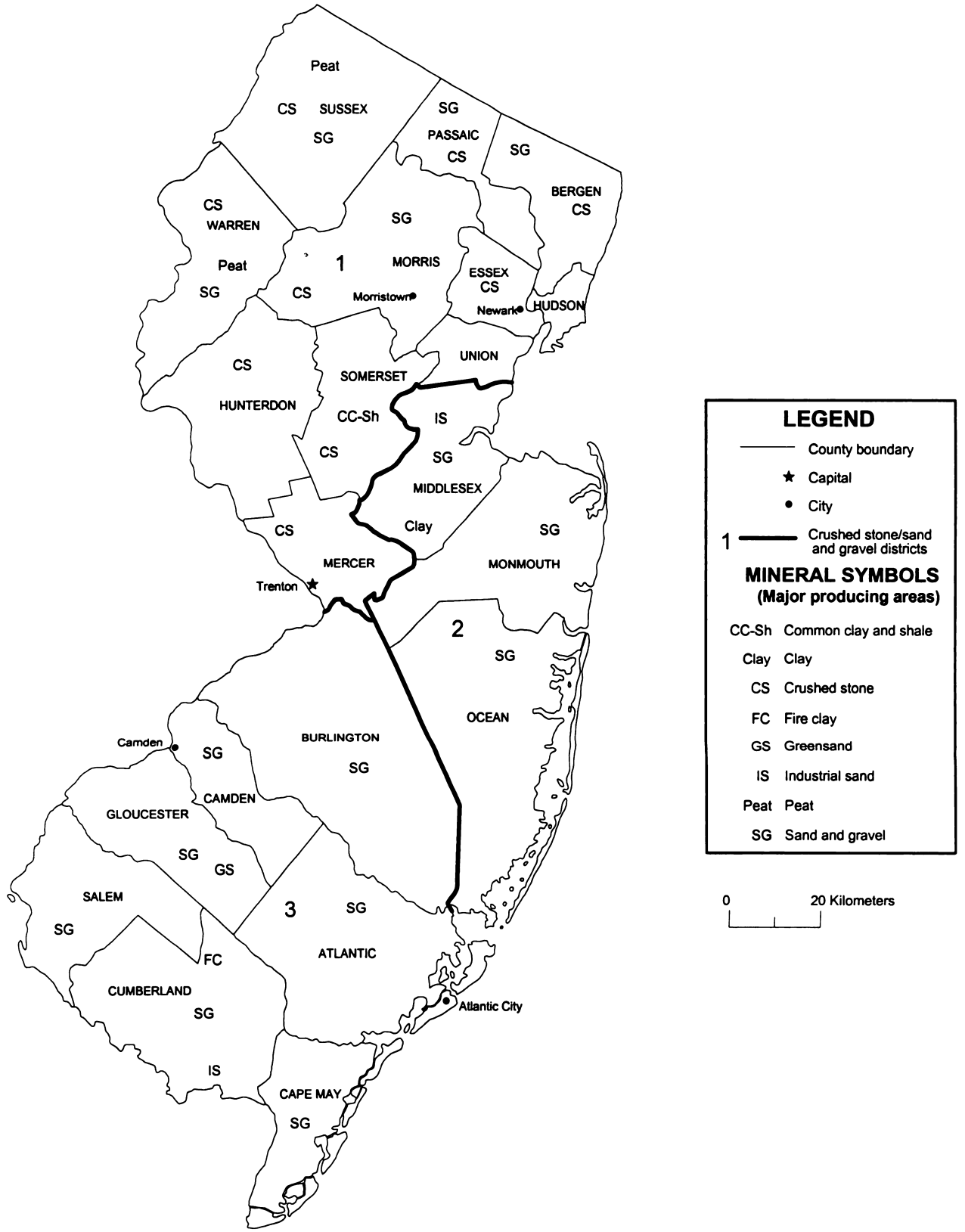
NEW JERSEY



Source: New Jersey Geological Survey/U.S. Geological Survey (1998)

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THE MINERAL INDUSTRY OF NEW JERSEY

This chapter has been prepared under a Memorandum of Understanding between the U.S. Geological Survey and the New Jersey Geological Survey for collecting information on all nonfuel minerals.

In 1998, the preliminary estimated value[1] of nonfuel mineral production for New Jersey was $301 million, according to the U.S. Geological Survey (USGS). This was nearly a 13% increase from that of 1997,[2] and followed an 8.5% increase from 1996 to 1997.

Crushed stone and construction sand and gravel, by value, were New Jersey's leading nonfuel mineral commodities. In 1998, the two commodities increased in value by about $21 million and $14 million, respectively, accounting for most of the State's increase in value. While gemstones and industrial sand and gravel values remained unchanged, the State's other mineral values increased, including those of greensand marl and peat, the data of which have been withheld to avoid disclosing company proprietary data. In 1997, construction sand and gravel with a $14.9 million increase lead the State's rise in value; crushed stone increased by $8 million.

Based on USGS estimates of the quantities of minerals produced in the United States in 1998, New Jersey remained seventh[2] among the States in industrial sand and gravel and increased to fifth from seventh in peat. The State continued to be the significantly larger producer of two States that now produce greensand marl. Greensand is used directly as an organic conditioner/fertilizer for soils and as a water filtration medium to remove soluble iron and manganese from well water.

The following narrative information was provided by the New Jersey Geological Survey[3] (NJGS). Although sand and gravel mining remained active during the year, little in the way of new mining operations came on-line during 1998. However, Sahara Sand, Inc. was able to increase its holdings by purchasing about 400 hectares (1,000 acres) of property from R.W.V. Land and Livestock South, Inc. The new properties include two mining sites in Monroe Township, Gloucester County, and one property in Eagleswood Township, Ocean County.

As was the case in 1997, the largest capital projects centered around the Atlantic City area with construction of new casino properties and the start of the Atlantic City/Brigantine Connector Tunnel Project. In 1998, the Mirage Resorts, Inc. project awarded contracts requiring the placement of about 1.4 million cubic meters of fill material (work starting in 1999). The Tunnel Project will require 612,000 cubic meters of specified structural fill (sand and gravel containing minimal amounts of fine grains). The first 7,650 cubic meters (10,000 cubic yards) of structural fill were placed during 1998. Other infrastructure and transportation projects started in and around Atlantic City included road improvements along U.S. Route 30, the Atlantic City Expressway, and the expansion of the Atlantic City International Airport.

Owing to a continuing increase in the use of Federal "Superpave" asphalt aggregate specifications, the demand for increasingly angular grained aggregate has greatly increased. As a result, demands for crushed stone increased substantially during the year, with some crushed rock being imported from as far away as Canada so as to meet customer demands.

Some interest remained in heavy mineral mining in the State, with a slight upturn in exploration activities. However, neither heavy mineral mining nor development took place during the year.

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[1]The terms "nonfuel mineral production" and related "values" encompass variations in meaning, depending on the minerals or mineral products. Production may be measured by mine shipments, mineral commodity sales, or marketable production (including consumption by producers) as is applicable to the individual mineral commodity.

All 1998 USGS mineral production data published in this chapter are preliminary estimates as of February 1999 and are expected to change. Construction sand and gravel and crushed stone estimates are updated periodically. To obtain the most current information, please contact the appropriate USGS mineral commodity specialist. A telephone listing for the specialists may be retrieved over the Internet at http://minerals.usgs.gov/minerals/contacts/comdir.html; by using MINES FaxBack at (703) 648-4999 from a fax machine with a touch-tone handset (request Document #1000 for a telephone listing of all mineral commodity specialists); or by calling USGS information at (703) 648-4000 for the specialist's name and number. All Mineral Industry Surveys—mineral commodity, State, and country—also may be retrieved over the Internet at http://minerals.usgs.gov/minerals; facsimile copies may be obtained from MINES FaxBack.

[2]Values, percentage calculations, and rankings for 1997 may vary from the *Minerals Yearbook, Area Reports: Domestic 1997, Volume II*, owing to the revision of preliminary 1997 to final 1997 data. Data for 1998 are preliminary and expected to change, while related rankings may also be subject to change.

[3]Lloyd Mullikin, Supervising Geologist with the New Jersey Geological Survey, authored the text of New Jersey mineral industry information submitted by that agency.

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TABLE 1
NONFUEL RAW MINERAL PRODUCTION IN NEW JERSEY 1/ 2/

(Thousand metric tons and thousand dollars unless otherwise specified)

Mineral	1996		1997		1998 p/	
	Quantity	Value	Quantity	Value	Quantity	Value
Clays: Common	74	125	W	131	W	134
Gemstones	NA	1	NA	1	NA	1
Sand and gravel:						
Construction	13,200	70,400	16,100	85,300	18,100	99,200
Industrial	1,680	30,300	1,530	28,300	1,540	28,300
Stone: Crushed	21,400	145,000	22,800	153,000	24,800	174,000
Total 3/	XX	246,000	XX	267,000	XX	301,000

p/ Preliminary. NA Not available. W Withheld to avoid disclosing company proprietary data. XX Not applicable.
1/ Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
2/ Data are rounded to three significant digits; may not add to totals shown.
3/ Partial total, excludes values which must be concealed to avoid disclosing company proprietary data.

TABLE 2
NEW JERSEY: CRUSHED STONE SOLD OR USED, BY KIND 1/
(Thousand metric tons)

Kind	1996				1997			
	Number of quarries	Quantity (thousand metric tons)	Value (thousands)	Unit value	Number of quarries	Quantity (thousand metric tons)	Value (thousands)	Unit value
Limestone	1	W	W	$12.34	4	W	W	$10.40
Granite	9	9,330	$75,500	8.09	9	9,820	$71,900	7.32
Traprock	9	9,690	56,100	5.79	10	11,700	67,600	5.78
Sandstone	1	W	W	5.29	1	W	W	5.43
Miscellaneous stone	1	W	W	4.13	1	W	W	11.74
Total	XX	21,400	145,000	6.79	XX	22,800	153,000	6.71

W Withheld to avoid disclosing company proprietary data; included in "Total." XX Not applicable.
1/ Data are rounded to three significant digits, except unit value; may not add to totals shown.

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TABLE 3
NEW JERSEY: CRUSHED STONE SOLD OR USED BY PRODUCERS
IN 1997, BY USE 1/ 2/

Use	Quantity (thousand metric tons)	Value (thousands)	Unit value
Coarse aggregate (+1 1/2 inch):			
Riprap and jetty stone	315	$2,230	$7.06
Filter stone	73	783	10.73
Other coarse aggregate 3/	119	757	6.36
Coarse aggregate, graded:			
Concrete aggregate, coarse	1,230	9,200	7.49
Bituminous aggregate, coarse	2,170	18,200	8.39
Bituminous surface-treatment aggregate	980	7,560	7.71
Railroad ballast	268	1,870	6.99
Other graded coarse aggregate	2,230	10,700	4.79
Fine aggregate (-3/8 inch):			
Stone sand, concrete	281	2,360	8.39
Stone sand, bituminous mix or seal	250	1,960	7.86
Screening, undesignated	1,580	10,300	6.55
Other fine aggregate	18	92	5.11
Coarse and fine aggregates:			
Graded road base or subbase	433	3,300	7.61
Terrazzo and exposed aggregate	7	188	26.86
Crusher run or fill or waste	330	1,570	4.75
Other coarse and fine aggregates 4/	3,600	24,100	6.69
Agriculture:			
Agriculture limestone	104	1,250	12.02
Poultry grit and mineral food	9	200	22.22
Chemical and metallurgical:			
Lime manufacture	18	100	5.56
Chemical stone	6	105	17.50
Special:			
Whiting or whiting substitute	W	W	13.74
Roofing granules	W	W	21.00
Unspecified: 5/			
Actual	W	W	4.32
Estimated	5,980	37,900	6.34
Total	22,800	153,000	6.71

W Withheld to avoid disclosing company proprietary data; included in "Total."
1/ Data are rounded to three significant digits, except unit value; may not add to totals shown.
2/ Includes granite, limestone, miscellaneous stone, sandstone, and traprock.
3/ Includes macadam.
4/ Includes unpaved road surfacing.
5/ Includes reported and estimated production without a breakdown by end use.

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TABLE 4
NEW JERSEY: CRUSHED STONE SOLD OR USED
BY PRODUCERS IN 1997,
BY USE AND DISTRICT 1/ 2/

(Thousand metric tons and thousand dollars)

Use	District 1	
	Quantity	Value
Construction aggregates:		
Coarse aggregate (+1 1/2 inch) 3/	508	3,770
Coarse aggregate, graded 4/	6,880	47,500
Fine aggregate (-3/8 inch) 5/	2,130	14,800
Coarse and fine aggregate 6/	4,690	35,800
Agricultural 7/	113	1,450
Chemical and metallurgical 8/	W	W
Special 9/	91	1,250
Unspecified 10/		
Actual	W	W
Estimated	5,980	37,900
Total	22,800	153,000

W Withheld to avoid disclosing company proprietary company data; included in "Total."
1/ Data are rounded to three significant digits; may not add to totals shown.
2/ No production reported for District 2; District 3 included with District 1 to avoid disclosing company proprietary data.
3/ Includes filter stone, macadam, riprap and jetty stone, and other coarse aggregate.
4/ Includes concrete aggregate (coarse), bituminous aggregate (coarse), bituminous surface-treatment aggregate, railroad ballast, and other graded coarse aggregate.
5/ Includes stone sand (concrete), stone sand (bituminous mix or seal), screening (undesignated), and other fine aggregate.
6/ Includes graded roadbase or subbase, unpaved road surfacing, terrazzo and exposed aggregate, crusher run (select or material use), and other coarse and fine aggregates.
7/ Includes agricultural limestone and poultry grit and mineral food.
8/ Includes lime manufacture and chemical stone for alkali works.
9/ Includes whiting or whiting substitute and roofing granules.
10/ Includes reported and estimated production without a breakdown by end use.

TABLE 5
NEW JERSEY: CONSTRUCTION SAND AND GRAVEL SOLD OR USED IN 1997,
BY MAJOR USE CATEGORY 1/

Use	Quantity (thousand metric tons)	Value (thousands)	Value per ton
Concrete aggregate (including concrete sand)	6,200	$34,000	$5.47
Plaster and gunite sands	276	1,570	5.70
Concrete products (blocks, bricks, pipe, decorative, etc.)	260	1,410	5.44
Asphaltic concrete aggregates and other bituminous mixtures	2,260	12,400	5.45
Road base and coverings	331	2,080	6.28
Fill	1,070	2,470	2.30
Snow and ice control	96	630	6.56
Other miscellaneous uses 2/	222	1,560	7.00
Unspecified: 3/			
Actual	3,880	21,800	5.63
Estimated	1,460	7,410	5.06
Total or average	16,100	85,300	5.31

1/ Data are rounded to three significant digits; may not add to totals shown.
2/ Includes filtration.
3/ Includes reported and estimated production without a breakdown by end use.

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TABLE 6

NEW JERSEY: CONSTRUCTION SAND AND GRAVEL SOLD OR USED IN 1997, BY USE AND DISTRICT 1/

(Thousand metric tons and thousand dollars)

Use	District 1		District 2		District 3	
	Quantity	Value	Quantity	Value	Quantity	Value
Concrete aggregates	774	4,930	3,160	18,000	2,270	11,100
Concrete products 2/	127	1,010	36	277	373	1,700
Asphaltic concrete aggregates and road base materials	124	943	1,810	9,930	658	3,560
Snow and ice control	66	482	W	W	W	W
Other miscellaneous uses 3/	245	1,550	354	569	725	2,050
Unspecified: 4/	661	2,940	1,770	10,600	2,910	15,800
Total	2,000	11,900	7,130	39,300	6,940	34,100

W Withheld to avoid disclosing company proprietary data; included with "Other miscellaneous uses."

1/ Data are rounded to three significant digits; may not add to totals shown.

2/ Includes plaster and gunite sands.

3/ Includes fill and filtration.

4/ Includes reported and estimated production without a breakdown by end use.

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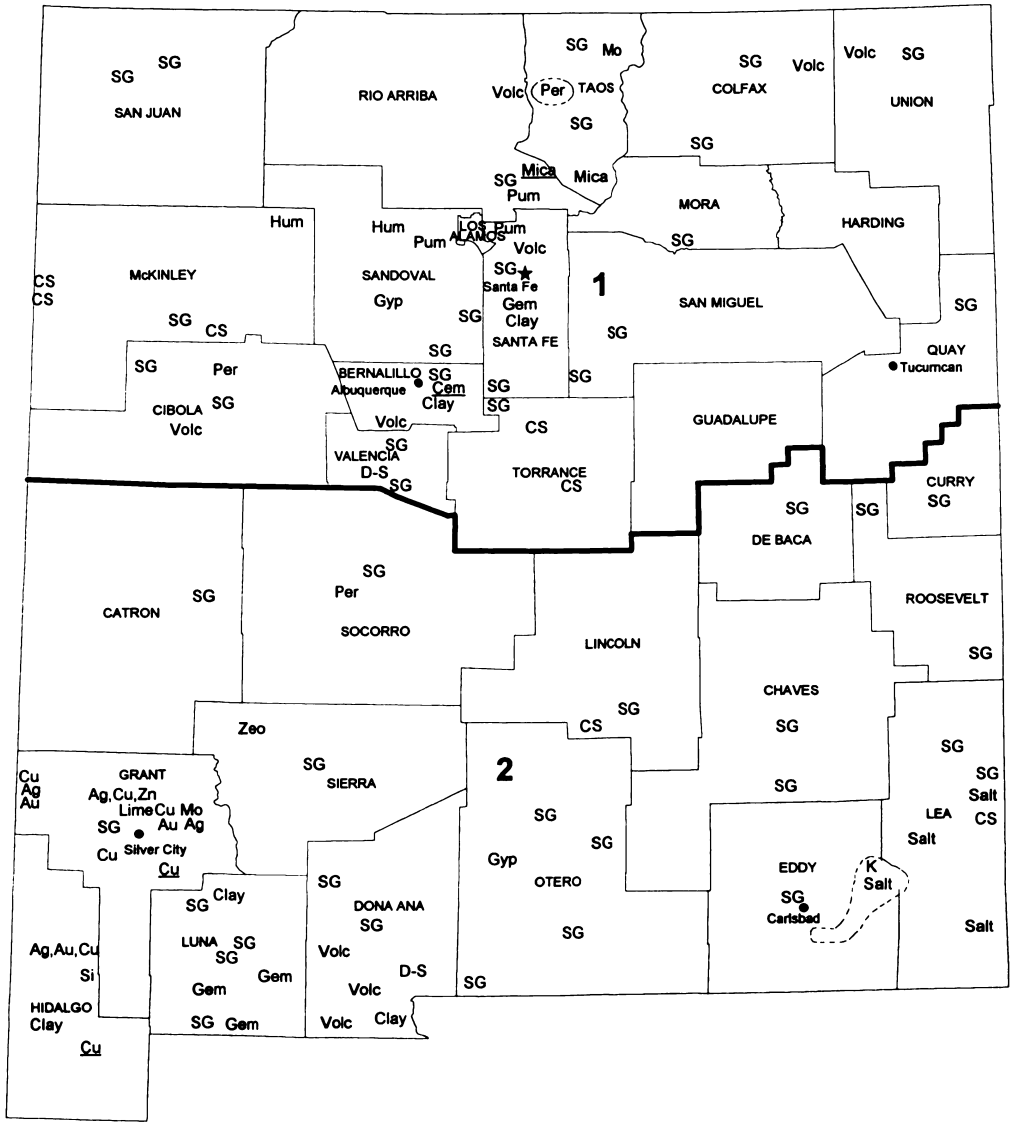
NEW MEXICO



LEGEND

- County boundary
- ★ Capital
- ● City
- 1 Crushed stone/sand and gravel districts

MINERAL SYMBOLS
(Major producing areas)

Ag	Silver
Au	Gold
Cem	Cement plant
Clay	Clay
CS	Crushed stone
Cu	Copper
Cu	Copper plant
D-S	Dimension stone
Gem	Gemstones
Gyp	Gypsum
Hum	Humate
K	Potash
Lime	Limestone
Mica	Mica
Mica	Mica plant
Mo	Molybdenum
Per	Perlite
Pum	Pumice
Salt	Salt
SG	Sand and gravel
Si	Silica
Volc	Volcanic cinder
Zeo	Zeolites
Zn	Zinc
⬭	Concentration of mineral operations

0 — 100 Kilometers

Source: New Mexico Bureau of Mines and Mineral Resources/U.S. Geological Survey (1998)

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THE MINERAL INDUSTRY OF NEW MEXICO

This chapter has been prepared under a Memorandum of Understanding between the U.S. Geological Survey and the New Mexico Bureau of Mines and Mineral Resources for collecting information on all nonfuel minerals.

In 1998, the preliminary estimated value[1] of nonfuel mineral production for New Mexico was $860 million, according to the U.S. Geological Survey (USGS). This was a 17% decrease from that of 1997[2] following a 4.8% increase from 1996 to 1997. The State decreased to 18th from 14th in rank among the 50 States in total nonfuel mineral production value, of which New Mexico accounted for more than 2% of the U.S. total.

The top nonfuel minerals mined in New Mexico were, by value, copper and potash, followed by construction sand and gravel and portland cement. Together, these four accounted for about 88% of the State's total nonfuel mineral production value. In 1998, decreases in the values of copper (down 29%) and potash (down 7%) accounted for the large majority of the State's drop in value. Smaller—yet significant—decreases also occurred in dimension stone and gold. Most other mineral commodities increased in value, led by crushed stone, up $12.5 million, and construction sand and gravel, up $8.4 million. In 1997, most of the increase in value resulted from rises in the values of molybdenum and potash. The largest decreases in value (in descending order of change) occurred in crushed stone, copper, and construction sand and gravel (table 1).

Based on USGS estimates of the quantities of minerals produced in the 50 States during 1998, New Mexico continued to lead[2] the Nation in potash, perlite, and zeolites and remained second in pumice, third in copper and crude mica, and sixth in molybdenum. Additionally, the State rose from 11th to 10th in the production of crude gypsum.

The following narrative information was provided by the New Mexico Bureau of Mines and Mineral Resources (BMMR).[3] Production data in the following text are those reported by the BMMR, based on canvass survey data collected by New Mexico's Department of Energy, Minerals and Natural Resources and related information collected by the BMMR. They may differ from some production figures reported to the USGS. Metals prices continued to drop in 1998 resulting in layoffs and mine closures and cutbacks. Phelps Dodge Corp. continued to mine copper at Santa Rita (Chino) and Tyrone. Copper prices fell in response to increased inventories worldwide. The Comex spot price averaged $1.35 per pound in 1995, $1.06 per pound in 1996, $1.04 per pound in 1997, and $0.75 per pound in 1998.

Phelps Dodge's 66.7%-owned Chino Mine in Santa Rita produced 77,600 metric tons (t) of copper concentrate and precipitate and 65,700 t of copper by solvent extraction-electrowinning (SX-EW) (Phelps Dodge Corp., 1999). Estimated milling reserves in 1998 are 318 million metric tons (Mt) of 0.62% copper and estimated leaching reserves are 438 Mt of 0.3% copper. On October 21, 1998, Phelps Dodge Corp. announced that production will be curtailed at Chino as a result of the copper price decrease. At Phelps Dodge's Tyrone Mine, copper production by SX-EW in 1998 amounted to 74,900 t of copper. Leaching reserves (recoverable copper) were estimated as 423 Mt of ore grading 0.32% copper (Phelps Dodge Corp., 1999).

On Feb. 3, 1998, Phelps Dodge Corp. acquired Cobre Mining Co., Inc. for approximately $115 million. The acquisition included the open pit mine, two underground mines, two mills, and surrounding 4,500 hectares of land. Estimated milling reserves in 1998 were 121 Mt of 0.73% copper and estimated leaching reserves were 89 Mt of 0.35% copper (Phelps Dodge Corp., 1999). Most of the copper reserves at the Cobre Mine are in the Syrena and upper part of the Lake Valley limestones north of the Barringer fault. Chalcopyrite is the chief ore mineral, with minor magnetite and iron-rich sphalerite. Copper production from the Cobre Mine amounted to 31,000 t in 1998. The mine was closed at the end of 1998 because of the drop in copper prices.

Environmental Impact Statements (EIS) are being prepared for expansions at Santa Rita, Chino, and Cobre mines. In addition, Phelps Dodge Corp., in voluntary cooperation with the New Mexico Environment Department, is beginning reclamation at six sites in the Silver City area affected by historic mining: Whitewater Creek, Hanover Creek, Lampbright area, Hurley smelter, town of Hurley, and tailings area south of the smelter. The first stage is to develop a background report defining the problems. Successive stages will involve remedial investigations, a feasibility study, and remedial action.

The opening of the Copper Flat Mine at Hillsboro has been delayed until a final decision by the Bureau of Land Management (BLM) on the draft EIS (released February 1996). BMMR held public hearings in late 1996, and a mining permit may be issued in 2000.

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[1]The terms "nonfuel mineral production" and related "values" encompass variations in meaning, depending on the minerals or mineral products. Production may be measured by mine shipments, mineral commodity sales, or marketable production (including consumption by producers) as is applicable to the individual mineral commodity.

All 1998 USGS mineral production data published in this chapter are preliminary estimates as of February 1999 and are expected to change. For some mineral commodities (for example, construction sand and gravel, crushed stone, and portland cement), estimates are updated periodically. To obtain the most current information, please contact the appropriate USGS mineral commodity specialist. A telephone listing for the specialists may be retrieved over the Internet at http://minerals.usgs.gov/minerals/contacts/comdir.html; by using MINES FaxBack at (703) 648-4999 from a fax machine with a touch-tone handset (request Document #1000 for a telephone listing of all mineral commodity specialists); or by calling USGS information at (703) 648-4000 for the specialist's name and number. All Mineral Industry Surveys—mineral commodity, State, and country—also may be retrieved over the Internet at http://minerals.usgs.gov/minerals; fascimile copies may be obtained from MINES FaxBack.

[2]Values, percentage calculations, and rankings for 1997 may vary from the *Minerals Yearbook, Area Reports: Domestic 1997, Volume II*, owing to the revision of preliminary 1997 to final 1997 data. Data for 1998 are preliminary and expected to change, while related rankings may also be subject to change.

[3]Virginia McLemore, Senior Economic Geologist, authored the information submitted by the New Mexico Bureau of Mines and Mineral Resources.

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In July, Summo Minerals Corp. of Vancouver dropped the Champion Mine claims at the Copper Hill deposit in the Picuris district in Taos County. The deposit, near Dixon, has reserves estimated at 42.2 Mt of ore grading 0.42% copper. BLM and the Picuris Pueblo are opposed to the mine because it sits between two canyons that drain into the Rio Grande and Rio Embudo—both may receive Wild and Scenic River designations.

Molycorp, Inc.'s (a subsidiary of Unocal Corp.) estimated production for 1998 was 5,400 t of molybdenite. Ore grade was estimated as 0.3% to 0.5% Mo. There are now three shifts, totaling 300 people, working at the mine and mill. The company continued with a reclamation and revegetation program to cover overburden dumps at the inactive open pit mine site. A proposed expansion plan was announced in September that would mine an estimated 64 Mt of ore reserves. However, as a result of drop in molybdenum prices at the end of 1998, Molycorp announced that it will curtail production at the Questa Mine and lay off 154 employees.

St. Cloud Mining Co. (a subsidiary of The Goldfield Corp.) operated a zeolite open pit mine in Sierra County since 1990. In 1998, St. Cloud produced 12,787 t of natural zeolite, compared to 13,620 t and 13,114 t in 1997 and 1996, respectively. St. Cloud Mining Co. has made several modifications to its zeolite operation, including the addition of cation exchange capacity for added value products and additional classification capabilities to expand markets for its products.

St. Cloud owns claims in the Lordsburg mining district in Hidalgo County where 15,011 t of construction aggregate material was produced in 1998, compared to 22,274 t and 12,764 t in 1997 and 1996, respectively (The Goldfield Corp., 1999, Form 10K to Securities and Exchange Commission, accessed November 2, 1999, at URL www.sec.gov/Archives/edgar/data/42316/0000042316-99-000010.txt).

El Cajete pumice mine expansion in the Jemez Mountains (Copar Pumice Co.) was delayed until preparation of an EIS (draft released early 1997). The mine opened in 1997 and is expected to operate for 10 years. Reserves are estimated at 90,000 t of pumice that will be used in making stonewashed jeans. Other pumice mines are active in the region.

The Carlsbad potash district is the largest potash-producing area in the United States. Mississippi Potash, Inc. (a subsidiary of Mississippi Chemical Corp.) and IMC Kalium Potash Mines (a subsidiary of IMC Global Inc.) operate mines in the district. Mining is by underground methods; solution mining is locally used as well. Sodium salt is also produced locally. Potash is used mainly in fertilizers. In 1998, IMC Kalium Potash Mines began construction of a new processing facility.

The MICA Mine in Taos County, owned by KMG Minerals Division of Franklin Industries, Inc., announced expansion plans in early 1999. The current mine is the fourth largest scrap mica mine in the United States and covers approximately 4.5 hectares. The expansion calls for an increase to 36 hectares within 20 years. The nearby Picuris Pueblo opposes any expansion of the mine.

Increase in the price of uranium led to the continued operation by Quivira Mining Co. (subsidiary of Rio Algom Ltd., successor to Kerr McGee Corp.) of minewater recovery of uranium from waters recovered from inactive underground operations at Ambrosia Lake, Grants, NM. Minewater recovery ceased in 1992 because of decline in the price of uranium but resumed in 1994. Approximately 78 t of U_3O_8 were produced from minewater recovery. Hydro Resources, Inc. continues with plans to mine uranium by in-situ leaching at Churchrock and NZU Inc. plans to mine at Crownpoint, also by in situ leaching.

Reference Cited

Phelps Dodge Corp., 1999, Phelps Dodge annual report 1998: Phelps Dodge Corp., 73 p.

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TABLE 1

NONFUEL RAW MINERAL PRODUCTION IN NEW MEXICO 1/ 2/

(Thousand metric tons and thousand dollars unless otherwise specified)

Mineral		1996 Quantity	1996 Value	1997 Quantity	1997 Value	1998 p/ Quantity	1998 p/ Value
Clays:							
Common		32	165	32	168	33	171
Fire		W	W	1	17	1	17
Copper 3/		256	614,000	259	612,000	248	437,000
Gemstones		NA	54	NA	W	NA	11
Potash		2,430	225,000	W	W	W	W
Pumice and pumicite	metric tons	102,000	527	W	W	W	W
Sand and gravel: Construction		9,880	48,500	9,390	46,600	10,700	55,000
Stone: Crushed 4/		3,480	18,800	2,920	15,700	4,700	28,200
Zeolites	metric tons	W	NA	W	NA	NA	NA
Combined values of cement [masonry (1997-98) portland], gold, gypsum (crude) iron ore (usable), mica (crude), molybdenum, perlite (crude), salt, silver, stone [crushed quartzite and traprock (1996), crushed traprock (1997-98), dimension granite and marble (1996-97), dimension miscellaneous (1998)], and values indicated symbol W		XX	85,100	XX	363,000	XX	340,000
Total		XX	992,000	XX	1,040,00	XX	860,000

p/ Preliminary. NA Not available. W Withheld to avoid disclosing company proprietary data; value included with "Combined values" data. XX Not applicable.

1/ Production as measured by mine shipments, sales, or marketable production (including consumption by producers).

2/ Data are rounded to three significant digits; may not add to totals shown.

3/ Recoverable content of ores, etc.

4/ Excludes certain stones; value included with "Combined values" data.

TABLE 2

NEW MEXICO: CRUSHED STONE SOLD OR USED, BY KIND 1/

Kind	1996 Number of quarries	1996 Quantity (thousand metric tons)	1996 Value (thousands)	1996 Unit value	1997 Number of quarries	1997 Quantity (thousand metric tons)	1997 Value (thousands)	1997 Unit value
Limestone	23	1,350	$6,090	$4.50	22	1,230	$5,670	$4.63
Granite	6	1,490	9,240	6.20	6	870	6,160	7.08
Volcanic cinder and scoria	5	283	2,170	7.66	5	276	2,420	8.78
Traprock	1	(2/)	(2/)	(2/)	(2/)	(2/)	(2/)	(2/)
Quartzite	1	(2/)	(2/)	(2/)	--	--	--	--
Miscellaneous stone	2	348	1,350	3.87	4	554	1,410	2.54
Total	XX	3,480	18,800	5.42	XX	2,920	15,700	5.36

XX Not applicable.

1/ Data are rounded to three significant digits; may not add to totals shown.

2/ Excluded from State total to avoid disclosing company proprietary data.

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TABLE 3
NEW MEXICO: CRUSHED STONE SOLD OR USED BY PRODUCERS
IN 1997, BY USE 1/ 2/

Use	Quantity (thousand metric tons)	Value (thousands)	Unit value
Coarse aggregate (+1 1/2 inch):			
Riprap and jetty stone	49	$296	$6.04
Other coarse aggregate 3/	8	66	8.25
Coarse aggregate, graded:			
Concrete aggregate, coarse	172	1,050	6.09
Bituminous aggregate, coarse	28	193	6.89
Bituminous surface-treatment aggregate	93	543	5.84
Other graded coarse aggregate 4/	491	3,990	8.13
Fine aggregate (-3/8 inch):			
Screening, undesignated	73	249	3.41
Other fine aggregate	34	131	3.85
Coarse and fine aggregates:			
Graded road base or subbase	444	1,870	4.21
Crusher run or fill or waste	21	55	2.62
Other coarse and fine aggregate	14	84	6.00
Other construction materials 5/	85	443	5.21
Chemical and metallurgical: Cement manufacture	W	W	4.90
Special: Roofing granules	W	W	20.83
Other miscellaneous uses not listed	W	W	27.60
Unspecified: 6/			
Actual	263	299	1.14
Estimated	457	1,850	4.06
Total	2,920	15,700	5.36

W Withheld to avoid disclosing company proprietary data; included in "Total."
1/ Includes granite, limestone, miscellaneous stone, and volcanic cinder and scoria; excludes quartzite and traprock from State total to avoid disclosing company proprietary data.
2/ Data are rounded to three significant digits, except unit value; may not add to totals shown.
3/ Includes filter stone.
4/ Includes railroad ballast.
5/ Includes terrazzo and exposed aggregate.
6/ Includes reported and estimated production without a breakdown by end use.

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TABLE 4

NEW MEXICO: CRUSHED STONE SOLD OR USED BY PRODUCERS IN 1997, BY USE AND DISTRICT 1/ 2/

(Thousand metric tons and thousand dollars)

Use	District 1		District 2		Unspecified districts	
	Quantity	Value	Quantity	Value	Quantity	Value
Construction aggregates:						
Coarse aggregate (+1 1/2 inch) 3/	W	W	W	W	--	--
Coarse aggregate, graded 4/	W	W	W	W	--	--
Fine aggregate (-3/8 inch) 5/	W	W	W	W	--	--
Coarse and fine aggregate 6/	324	1,630	W	W	--	--
Other construction materials	W	W	W	W	--	--
Chemical and metallurgical 7/	W	W	--	--	--	--
Other miscellaneous use	47	1,300	--	--	--	--
Unspecified 8/						
Actual	--	--	--	--	263	(9/)
Estimated	330	1,290	127	(9/)	--	--
Total	2,120	13,300	543	2,090	263	(9/)

W Withheld to avoid disclosing company proprietary data; included in "Total."

1/ Data are rounded to three significant digits; may not add to totals shown.

2/ Includes limestone, granite, volcanic cinder and scoria, and miscellaneous stone; excludes traprock from State total to avoid disclosing company proprietary data.

3/ Includes filter stone, riprap and jetty stone, and other coarse aggregate.

4/ Includes concrete aggregate (coarse), bituminous aggregate (coarse), bituminous surface-treatment aggregate, railroad ballast, and other graded coarse aggregate.

5/ Includes stone sand (concrete) and screening (undesignated).

6/ Includes graded road base or subbase, terrazzo and exposed aggregate, crusher run (select material or fill), roofing granules, and other coarse and fine aggregates.

7/ Includes cement manufacture.

8/ Includes reported and estimated production without a breakdown by end use.

9/ Less than 1/2 unit.

TABLE 5

NEW MEXICO: CONSTRUCTION SAND AND GRAVEL SOLD OR USED IN 1997, BY MAJOR USE CATEGORY 1/

Use	Quantity (thousand metric tons)	Value (thousands)	Value per ton
Concrete aggregate	1,870	$10,600	$5.66
Concrete products 2/	256	1,480	5.76
Asphaltic concrete aggregates and other bituminous mixtures	1,210	7,070	5.84
Road base and coverings	1,870	8,640	4.61
Fill	481	1,860	3.87
Other miscellaneous uses	81	406	5.01
Unspecified 3/			
Actual	1,540	6,390	4.15
Estimated	2,080	10,200	4.92
Total or average	9,390	46,600	4.97

1/ Data are rounded to three significant digits; may not add to totals shown.

2/ Includes plaster and gunite sands.

3/ Includes reported and estimated production without a breakdown by end use.

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TABLE 6
NEW MEXICO: CONSTRUCTION SAND AND GRAVEL SOLD OR USED IN 1997,
BY USE AND DISTRICT 1/

(Thousand metric tons and thousand dollars)

Use	District 1		District 2		Unspecified districts	
	Quantity	Value	Quantity	Value	Quantity	Value
Concrete aggregate	1,390	7,450	475	3,130	--	--
Concrete products 2/	228	1,340	28	135	--	--
Asphaltic concrete aggregates and roadbase materials	2,140	10,700	948	5,040	--	--
Other miscellaneous uses 3/	312	1,300	250	964	--	--
Unspecified 4/	2,780	14,200	307	1,560	534	884
Total	6,850	34,900	2,010	10,800	534	884

1/ Data are rounded to three significant digits; may not add to totals shown.
2/ Includes plaster and gunite sands.
3/ Includes fill.
4/ Includes reported and estimated production without a breakdown by end use.

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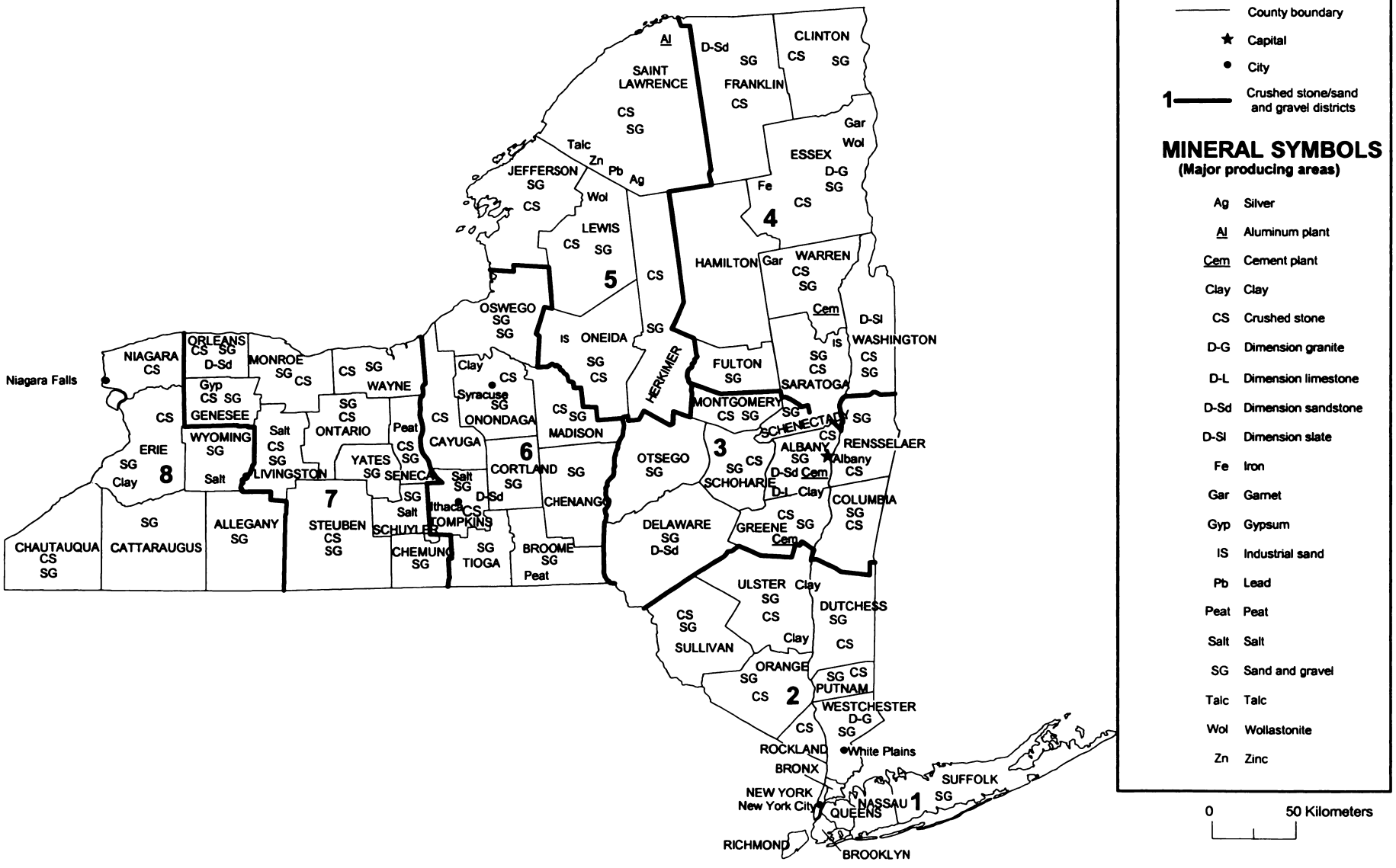
NEW YORK



Source: New York State Geological Survey/U.S. Geological Survey (1998)

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THE MINERAL INDUSTRY OF NEW YORK

This chapter has been prepared under a Memorandum of Understanding between the U.S. Geological Survey and the New York State Geological Survey for collecting information on all nonfuel minerals.

In 1998, the preliminary estimated value[1] of nonfuel mineral production for New York was $983 million, according to the U.S. Geological Survey (USGS). This was about a 3% increase from that of 1997,[2] and followed a 7.4% increase from 1996 to 1997. New York rose in State ranking to 14th from 16th in the Nation in total nonfuel mineral production value, of which the State accounted for more than 2% of the U.S. total.

In 1998, crushed stone, by value, remained New York's leading nonfuel mineral, followed by portland cement, construction sand and gravel, salt, and zinc. These five mineral commodities accounted for about 91% of the State's total nonfuel mineral production value, of which industrial minerals and mineral products represented about 94%. Zinc accounted for the major portion of metal production and value. The State's net value increase in 1998 resulted mostly from a $37 million rise in the value of crushed stone, a $23 million increase in construction sand and gravel, and a more moderate yet substantial increase in portland cement (table 1). Only salt and zinc values (listings are by descending magnitude of change) showed similarly significant decreases in value. Smaller decreases also took place: crude gypsum had a decrease of less than $3 million and wollastonite and dimension stone were down about $1 million each. All other nonfuel minerals had relatively small increases, except talc, which showed a small decrease, and industrial sand and gravel, which remained unchanged.

In 1997, a substantial increase in the value of crushed stone plus a combined increase of more than $15 million in zinc and wollastonite lead New York's rise in value for the year. While most of the State's other nonfuel minerals showed decreases in value, only salt, common clay, and construction sand and gravel decreased by $1 million or more.

Based on USGS estimates of the quantities produced in the 50 States in 1998, New York remained the only[2] State to produce wollastonite, second of three industrial garnet-producing States, third in the production of salt and zinc, fourth in talc, sixth in lead, and eighth in portland cement. The State dropped to 11th from 6th in dimension stone. Additionally, New York mining and mineral processing operations produced substantial quantities of crushed stone, construction sand and gravel, and masonry cement.

The following narrative information was provided by the New York State Geological Survey (NYSGS) and the Division of Mineral Resources of the New York State Department of Environmental Conservation (NYSDEC).[3] The NYSDEC issued a total of 514 Mined Land Reclamation permits in 1998, 88 of which were for new mines. Another 70 mines were approved for final reclamation. Total hectares reclaimed for the year were 241. At the end of 1998, 2,463 mines—1,814 industry-owned and 649 government-owned (municipal)—were active in the State. The number of hectares under permit at the end of 1998 was about 18,800 with more than 16,700 hectares affected by industry-owned mines and the remainder by government-owned mines. Total hectares reclaimed in 1998 were almost 1,980, of which about 1,850 were on industry-owned properties. The total value of reclamation financial security held by the department equaled almost $69.9 million.

American Rock Salt Inc. (ARS) broke ground on its new underground salt mine at Hampton Corners in the Town of Groveland, Livingston County, in the fall of 1998 and was on schedule with its construction. The mine site is about 3 kilometers southeast of the southeastern limit of the failed Akzo Nobel Salt Inc. mine at Retsof, NY. Salt will be mined at the same stratigraphic level as the old Akzo Nobel Mine. Surface development had been slowed by inclement weather, but the sinking of the shaft continued through the winter months of 1999. Service and production shafts were excavated through unconsolidated materials to the top of bedrock at an approximate depth of 21 meters. Archeological work was completed by the end of winter on one of three sites that required archeological field inspections. The excavation of American Indian human remains discovered at the site slowed work on the rail spur line that will connect the new facility with existing rail lines of the Genesee and Wyoming Railroad. ARS anticipates that the mine will start producing development salt in October 1999 and will go into full production during 2000.

[1]The terms "nonfuel mineral production" and related "values" encompass variations in meaning, depending on the minerals or mineral products. Production may be measured by mine shipments, mineral commodity sales, or marketable production (including consumption by producers) as is applicable to the individual mineral commodity.

All 1998 USGS mineral production data published in this chapter are preliminary estimates as of February 1999 and are expected to change. For some mineral commodities (for example, construction sand and gravel, crushed stone, and portland cement), estimates are updated periodically. To obtain the most current information, please contact the appropriate USGS mineral commodity specialist. A telephone listing for the specialists may be retrieved over the Internet at http://minerals.usgs.gov/minerals/contacts/comdir.html; by using MINES FaxBack at (703) 648-4999 from a fax machine with a touch-tone handset (request Document #1000 for a telephone listing of all mineral commodity specialists); or by calling USGS information at (703) 648-4000 for the specialist's name and number. All Mineral Industry Surveys—mineral commodity, State, and country—also may be retrieved over the Internet at http://minerals.usgs.gov/minerals; facsimile copies may be obtained from MINES FaxBack.

[2]Values, percentage calculations, and rankings for 1997 may vary from the *Minerals Yearbook, Area Reports: Domestic 1997, Volume II*, owing to the revision of preliminary 1997 to final 1997 data. Data for 1998 are preliminary and expected to change, while related rankings may also be subject to change.

[3]William Kelly, Associate Scientist with the New York State Geological Survey, and Steven Potter, Mined Land Reclamation Specialist II with the New York State Department of Environmental Conservation, Division of Mineral Resources, coauthored the text of mineral industry information submitted by those agencies. Mr. Potter may be contacted at his State agency, 50 Wolf Rd, Albany, NY 12233, telephone: (518) 457-9341; fax: (518) 457-9298;. the NYSDEC is on the Internet at http://www.dec.state.ny.us/website/dmn.

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In July 1998, the NYSDEC received a mining termination notice from the United States Gypsum Co. indicating its intention to close its underground gypsum mine in Oakfield, Genesee County. Mine closure and final reclamation are anticipated to continue through 1999 and be finalized during 2000.

Zinc Corporation of America notified the NYSDEC in August of its intention to close and reclaim the Hyatt Mine, in Edwards, St. Lawrence County. The completed reclamation of the site was anticipated to be fall 1999.

Although neither the State Governor nor the NYSDEC introduced any mining law reform legislation, bills dealing with amendments to the Mined Land Reclamation Law were introduced during the 1998-99 legislative session. No bills, the purpose of which would be to specifically clarify NYSDEC's role in underground mining regulation, have as yet been enacted.

The NYSGS released its Environmental Services Technical Report 98-001, *Seismic Hazard Assessment of Onondaga County*. The work leading to the report was performed by the NYSGS in conjunction with the New York State Emergency Management Office and the Federal Emergency Management Agency. In addition to maps of surficial and bedrock geology, depth-to-water-table, and slope, the publication contains landslide and liquefaction susceptibility, ground shaking amplification, and composite seismic hazard maps. Additionally, the NYSGS has available a digital version of the 1:250,000-scale surficial geologic map of the State. This is a materials-based map illustrating the location of sand and gravel, clay, and other mineral resources in addition to till and outcrops; as such, it is of interest to the mineral industry. The map can be obtained in ArcInfo and ArcView format at no cost. The data may be accessed at http://www.nysm.nysed.gov/ index.htlm by choosing "GIS Data and Map Server" and following the map download instructions. A corollary bedrock map was expected to be available at the same Internet address in late summer 1999.

TABLE 1
NONFUEL RAW MINERAL PRODUCTION IN NEW YORK 1/ 2/

(Thousand metric tons and thousand dollars unless otherwise specified)

Mineral	1996 Quantity	1996 Value	1997 Quantity	1997 Value	1998 p/ Quantity	1998 p/ Value
Cement: Portland	2,570	157,000 e/	W	W	W	W
Clays: Common	652	14,000	477	12,100	487	12,300
Gemstones	NA	291	NA	70	NA	100
Salt	4,420	203,000	3,590	183,000	3,400	161,000
Sand and gravel: Construction	28,100	145,000	28,500	144,000	32,100	167,000
Stone:						
Crushed	43,600	233,000	44,400	285,000	46,000	322,000
Dimension metric tons	34,400	8,120	54,700	9,380	31,200	8,330
Combined values of cement (masonry), garnet (industrial), gypsum (crude), lead, peat, sand and gravel (industrial), silver, talc and pyrophyllite, wollastonite, zinc, and values indicated by symbol W	XX	128,000 r/	XX	321,000	XX	313,000
Total	XX	889,000 r/	XX	955,000	XX	983,000

e/ Estimated. p/ Preliminary. r/ Revised. NA Not available. W Withheld to avoid disclosing company proprietary data; value included with "Combined values" data. XX Not applicable.

1/ Production as measured by mine shipments, sales, or marketable production (including consumption by producers).

2/ Data are rounded to three significant digits; may not add to totals shown.

TABLE 2
NEW YORK: CRUSHED STONE SOLD OR USED, BY KIND 1/

Kind	1996 Number of quarries	1996 Quantity (thousand metric tons)	1996 Value (thousands)	1996 Unit value	1997 Number of quarries	1997 Quantity (thousand metric tons)	1997 Value (thousands)	1997 Unit value
Limestone	75 r/	22,300 r/	$105,000 r/	$4.71 r/	55	22,000	$119,000	$5.41
Dolomite	12 r/	8,610 r/	52,300 r/	6.08 r/	12	9,950	88,100	8.85
Limestone-dolomite	11	5,990	34,900	5.82	11	5,870	34,100	5.81
Granite	9 r/	2,190 r/	14,400 r/	6.58 r/	8	2,210	16,100	7.31
Traprock	2	W	W	W	2	W	W	W
Sandstone	7	1,990 r/	10,200 r/	5.14 r/	7	1,880	11,100	5.87
Marble	1	80	1,380	17.20	1	85	1,390	16.29
Slate	1	W	W	W	1	W	W	W
Miscellaneous stone	4 r/	1,220 r/	5,210 r/	4.27 r/	3	1,020	5,010	4.91
Total	XX	43,600	233,000	5.34	XX	44,400	285,000	6.43

r/ Revised. W Withheld to avoid disclosing company proprietary data; included in "Total." XX Not applicable.

1/ Data are rounded to three significant digits, except unit value; may not add to totals shown.

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TABLE 3
NEW YORK: CRUSHED STONE SOLD OR USED
BY PRODUCERS IN 1997, BY USE 1/ 2/

Use	Quantity (thousand metric tons)	Value (thousands)	Unit value
Coarse aggregate (+1 1/2 inch):			
Macadam	108	$1,170	$10.86
Riprap and jetty stone	399	2,980	7.46
Filter stone	84	596	7.10
Other coarse aggregate	987	5,890	5.96
Coarse aggregate, graded:			
Concrete aggregate, coarse	1,820	13,800	7.59
Bituminous aggregate, coarse	4,820	47,600	9.88
Bituminous surface-treatment aggregate	814	5,800	7.12
Railroad ballast	110	1,110	10.11
Other graded coarse aggregate	2,430	20,300	8.35
Fine aggregate (-3/8 inch):			
Stone sand, concrete	206	1,100	5.36
Stone sand, bituminous mix or seal	761	6,720	8.83
Screening, undesignated	616	6,120	9.93
Other fine aggregate	1,240	8,300	6.68
Coarse and fine aggregates:			
Graded road base or subbase	3,580	23,200	6.47
Unpaved road surfacing	155	997	6.43
Crusher run or fill or waste	3,450	21,300	6.17
Other coarse and fine aggregates	1,390	9,920	7.15
Other construction materials 3/	313	2,100	6.70
Agricultural:			
Agricultural limestone	136	1,500	11.01
Other agricultrual uses	6	64	10.67
Chemical and metallurgical:			
Cement manufacture	3,890	15,300	3.93
Lime manufacture	W	W	W
Special: Other fillers or extenders	W	W	W
Other miscellaneous uses not listed	3	17	5.67
Unspecified: 4/			
Actual	6,750	26,500	3.93
Estimated	9,900	59,600	6.02
Total	44,400	285,000	6.43

W Withheld to avoid disclosing company proprietary data; included in "Total."
1/ Includes dolomite, granite, limestone, limestone-dolomite, marble, sandstone, slate, traprock, and miscellaneous stone.
2/ Data are rounded to three significant digits, except unit value; may not add to totals shown.
3/ Includes terrazzo and exposed aggregate.
4/ Includes reported and estimated production without a breakdown by end use.

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TABLE 4
NEW YORK: CRUSHED STONE SOLD OR USED BY PRODUCERS IN 1997, BY USE AND DISTRICT 1/ 2/

(Thousand metric tons and thousand dollars)

Use	District 2		District 3		District 4		District 5	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
Construction aggregates:								
Coarse aggregate (+1 1/2 inch) 3/	190	2,180	227	1,820	67	427	W	W
Coarse aggregate, graded 4/	3,810	43,100	1,700	13,100	1,130	7,110	708	3,900
Fine aggregate (-3/8 inch) 5/	1,050	12,100	450	2,680	272	1,710	W	W
Coarse and fine aggregate 6/	1,280	11,200	980	6,400	808	5,190	1,280	5,190
Other construction materials 7/	--	--	238	1,740	19	83	257	1,310
Agricultural 8/	3	27	(9/)	(9/)	(9/)	(9/)	(9/)	(9/)
Chemical and metallurgical 10/	--	--	(9/)	(9/)	(9/)	(9/)	44	970
Special 11/	--	--	3	18	--	--	2	110
Unspecified: 12/								
Actual	--	--	(9/)	(9/)	--	--	(9/)	(9/)
Estimated	6,430	46,500	559	2,370	272	1,680	137	477
Total	12,800	115,000	7,670	43,400	3,300	18,400	4,360	20,700

Use	District 6		District 7		District 8		Unspecified districts	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
Construction aggregates:								
Coarse aggregate (+1 1/2 inch) 3/	W	W	W	W	15	192	--	--
Coarse aggregate, graded 4/	479	2,890	W	W	W	W	2	2
Fine aggregate (-3/8 inch) 5/	156	816	697	3,810	W	W	--	--
Coarse and fine aggregate 6/	755	4,160	1,070	5,950	W	W	27	44
Other construction materials 7/	18	131	1,980	11,200	3,610	30,500	--	--
Apeicultural 8/	13	209	(9/)	(9/)	72	1,040	--	--
Chemical and metallurgical 10/	--	--	--	--	--	--	--	--
Special 11/	(9/)	(9/)	--	--	--	--	--	--
Unspecified: 12/								
Actual	(9/)	(9/)	(9/)	(9/)	--	--	--	--
Estimated	543	2,310	1,800	5,930	165	373	--	--
Total	5,040	21,900	7,350	33,600	3,860	32,100	29	46

W Withheld to avoid disclosing company proprietary data; included with "Other construction materials."
1/ No crushed stone was produced in District 1.
2/ Data are rounded to three significant digits; may not add to totals shown.
3/ Includes filter stone, macadam, riprap and jetty stone, and other coarse aggregate.
4/ Includes concrete aggregate (coarse), bituminous aggregate (coarse), bituminous surface-treatment aggregate, railroad ballast, and other graded coarse aggregate.
5/ Includes stone sand (concrete), stone sand (bituminous mix or seal), screening (undesignated), and other fine aggregate.
6/ Includes graded road base or subbase, terrazzo and exposed aggregate, unpaved road surfacing, crusher run (select material or fill), and other coarse and fine aggregates.
7/ Includes drain fields.
8/ Includes agricultural limestone and other agricultural uses.
9/ Withheld to avoid disclosing company proprietary data; included in "Total."
10/ Includes cement and lime manufacture.
11/ Includes other fillers or extenders and other specified uses not listed.
12/ Includes reported and estimated production without a breakdown by end use.

TABLE 5
NEW YORK: CONSTRUCTION SAND AND GRAVEL SOLD OR USED IN 1997,
BY MAJOR USE CATEGORY 1/

Use	Quantity (thousand metric tons)	Value (thousands)	Value per ton
Concrete aggregate (including concrete sand)	7,320	$42,800	$5.84
Plaster and gunite sands	159	916	5.76
Concrete products (blocks, bricks, pipe, decorative, etc.)	329	2,470	7.52
Asphaltic concrete aggregates and other bituminous mixtures	2,440	12,900	5.31
Road base and coverings	4,340	17,700	4.09
Road stabilization (cement)	15	32	2.13
Road stabilization (lime)	24	98	4.08
Fill	2,660	7,030	2.64
Snow and ice control	1,670	6,620	3.96
Railroad ballast	9	25	2.78
Other miscellaneous uses	371	1,920	5.18
Unspecified: 2/			
Actual	2,630	11,800	4.47
Estimated	6,560	40,000	6.09
Total or average	28,500	144,000	5.06

1/ Data are rounded to three significant digits; may not add to totals shown.
2/ Includes reported and estimated production without a breakdown by end use.

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TABLE 6
NEW YORK: CONSTRUCTION SAND AND GRAVEL SOLD OR USED IN 1997,
BY USE AND DISTRICT 1/

(Thousand metric tons and thousand dollars)

Use	District 1		District 2		District 3		District 4	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
Concrete aggregate	1,850	10,800	765	6,110	910	4,050	171	678
Concrete products 2/	223	1,610	W					
Asphaltic concrete aggregates 3/	--	--	330	1,900			138	391
Roadbase and covering	199	2,000	286	1,920	623	2,080	436	1,260
Fill	61	334	494	1,110	696	2,020	587	829
Snow and ice control	37	211	263	1,630	274	959	188	570
Other miscellaneous uses 4/	--	--	W					
Unspecified 5/	1,620	17,300	439	2,240	85	176	1,010	3,770
Total	3,990	32,200	2,630	15,300	3,060	11,900	2,530	7,520

	District 5		District 6		District 7		District 8	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
Concrete aggregate	196	1,060	1,150	6,710	1,250	7,940	1,030	5,460
Concrete products 2/	W	W	W	W	187	1,210	--	--
Asphaltic concrete aggregates 3/	W	W	950	5,600	339	2,030	462	1,690
Roadbase and covering	381	1,240	1,110	3,940	715	2,460	588	2,840
Fill	142	297	349	1,040	77	193	251	1,210
Snow and ice control	138	394	445	1,490	249	988	79	384
Other miscellaneous uses 4/	8	30	W	W	14	65	30	116
Unspecified 5/	560	2,610	336	1,300	1,320	6,800	3,830	17,500
Total	1,430	5,640	4,470	20,800	4,150	21,700	6,270	29,200

W Withheld to avoid disclosing company proprietary data; included in "Total."
1/ Data are rounded to three significant digits; may not add to totals shown.
2/ Includes plaster and gunite sands.
3/ Includes fill and road and other stabilization (cement and lime).
4/ Includes railroad ballast.
5/ Includes reported and estimated production without a breakdown by end use.

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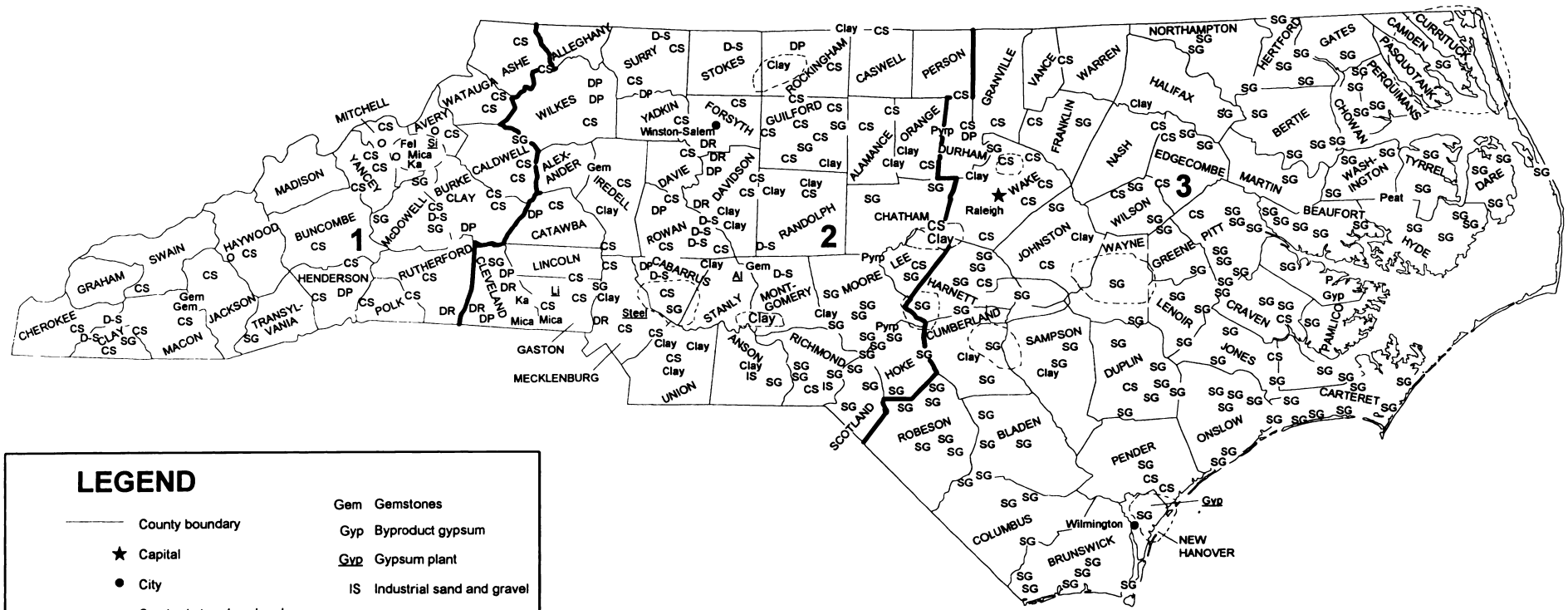
NORTH CAROLINA



LEGEND

- County boundary
- ★ Capital
- ● City
- 1 —— Crushed stone/sand and gravel districts

MINERAL SYMBOLS
(Major producing areas)

- Al Aluminum plant
- Clay Clay
- CS Crushed stone
- DR/DP Dregged/dipped sand and other surficial materials
- D-S Dimension stone
- Fel Feldspar
- Gem Gemstones
- Gyp Byproduct gypsum
- Gyp Gypsum plant
- IS Industrial sand and gravel
- Ka Kaolin
- Li Lithium mine and plant
- Mica Mica
- O Olivine
- P Phosphate rock
- Peat Peat
- Pyrp Pyrophyllite
- SG Sand and gravel
- Si Silica plant
- Steel Iron and steel plant
- Concentration of mineral operations

Source: North Carolina Geological Survey/U.S. Geological Survey (1998)

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THE MINERAL INDUSTRY OF NORTH CAROLINA

This chapter has been prepared under a Memorandum of Understanding between the U.S. Geological Survey and the North Carolina Geological Survey for collecting information on all nonfuel minerals.

In 1998, the preliminary estimated value[1] of nonfuel mineral production for North Carolina was $785 million, according to the U.S. Geological Survey (USGS). This was about a 6% increase from that of 1997[2] and followed a 7.5% increase from 1996 to 1997. The State remained 19th in rank among the 50 States in total nonfuel mineral production value, of which North Carolina accounted for about 2% of the U.S. total.

[1]The terms "nonfuel mineral production" and related "values" encompass variations in meaning, depending on the minerals or mineral products. Production may be measured by mine shipments, mineral commodity sales, or marketable production (including consumption by producers) as is applicable to the individual mineral commodity.

All 1998 USGS mineral production data published in this chapter are preliminary estimates as of February 1999 and are expected to change. For some mineral commodities (for example, construction sand and gravel, crushed stone, and portland cement), estimates are updated periodically. To obtain the most current information, please contact the appropriate USGS mineral commodity specialist. A telephone listing for the specialists may be retrieved over the Internet at http://minerals.usgs.gov/minerals/contacts/comdir.html; by using MINES FaxBack at (703) 648-4999 from a fax machine with a touch-tone handset (request Document #1000 for a telephone listing of all mineral commodity specialists); or by calling USGS information at (703) 648-4000 for the specialist's name and number. All Mineral Industry Surveys—mineral commodity, State, and country—also may be retrieved over the Internet at http://minerals.usgs.gov/minerals; facsimile copies may be obtained from MINES FaxBack.

[2]Values, percentage calculations, and rankings for 1997 may vary from the *Minerals Yearbook, Area Reports: Domestic 1997, Volume II*, owing to the revision of preliminary 1997 to final 1997 data. Data for 1998 are preliminary and expected to change, while related rankings may also be subject to change.

In 1998, the increased values of crushed stone and phosphate rock accounted for most of the State's rise in value. The only significant decreases were those that occurred for lithium minerals, feldspar, and construction sand and gravel (table 1). (Mineral commodity listings are in descending order of change.) Lithium mineral production declined because of the closure of FMC Corp., Lithium Division's, spodumene mine and lithium carbonate plant at Cherryville near Bessemer City, NC, early in 1998. In 1997, increases in the values of crushed stone, construction sand and gravel, phosphate rock, and industrial sand and gravel significantly offset a substantial decrease in the value of lithium minerals.

Based on 1998 USGS estimates of the quantities of minerals produced in the 50 States, North Carolina continued as the leading[2] State in feldspar, crude mica, and pyrophyllite production; second in common clays and second of two States that produced lithium minerals and olivine; sixth in industrial sand and gravel; and ninth in crushed stone. The State was second of four States that produce phosphate rock and eighth in the production of dimension stone. North Carolina mines exclusively have produced industrial minerals since the early 1970's, particularly since the 1971 closing of the Tungsten Queen Mine, an underground tungsten mine in Vance County. Metal production in the State, especially that of primary aluminum, resulted from the processing of recycled materials or raw materials received from other domestic and foreign sources.

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TABLE 1
NONFUEL RAW MINERAL PRODUCTION IN NORTH CAROLINA 1/ 2/

(Thousand metric tons and thousand dollars unless otherwise specified)

Mineral		1996 Quantity	1996 Value	1997 Quantity	1997 Value	1998 p/ Quantity	1998 p/ Value
Clays: Common		2,400	12,400	2,460	11,900	2,510	12,100
Feldspar	metric tons	481,000	18,400	467,000	18,700	368,000	15,800
Gemstones		NA	348 r/	NA	368	NA	369
Mica, crude		62	4,900	W	W	W	W
Peat		15	311	W	W	W	W
Sand and gravel:							
Construction		10,000	50,500	11,100	61,200	10,400	59,500
Industrial		1,500	21,700	1,600	26,400	1,630	27,200
Stone:							
Crushed		57,200	394,000	63,700	464,000	65,000	507,000
Dimension	metric tons	37,300	14,300	39,300	15,300	42,700	14,900
Combined values of clays (kaolin), lithium minerals, olivine, phosphate rock, talc and pyrophyllite, and values indicated by symbol W		XX	172,000	XX	143,000	XX	148,000
Total		XX	689,000 r/	XX	741,000	XX	785,000

p/ Preliminary. r/ Revised. NA Not available. W Withheld to avoid disclosing company proprietary data; value included with "Combined values" data. XX Not applicable.

1/ Production as measured by mine shipments, sales, or marketable production (including consumption by producers).

2/ Data are rounded to three significant digits; may not add to totals shown.

TABLE 2
NORTH CAROLINA: CRUSHED STONE SOLD OR USED, BY KIND 1/

Kind	1996 Number of quarries	1996 Quantity (thousand metric tons)	1996 Value (thousands)	1996 Unit value	1997 Number of quarries	1997 Quantity (thousand metric tons)	1997 Value (thousands)	1997 Unit value
Limestone	11	6,250	$43,200	$6.91	11	6,810	$48,400	$7.10
Dolomite	1	251	1,720	6.85	1	302	2,010	6.66
Calcareous marl	3	131	917	7.00	--	--	--	--
Granite	70 r/	41,500 r/	283,000 r/	6.81 r/	70	46,000	331,000	7.20
Traprock	8 r/	5,350 r/	37,900 r/	7.08 r/	7	6,560	51,400	7.84
Slate	3	W	W	7.35	3	W	W	7.55
Volcanic cinder and scoria	1	W	W	7.39	1	W	W	7.58
Quartzite	2	W	W	7.09	2	W	W	7.41
Miscellaneous stone	1	W	W	8.20	1	W	W	8.40
Total	XX	57,200	394,000	6.89	XX	63,700	464,000	7.28

r/ Revised. W Withheld to avoid disclosing company proprietary data; included in "Total." XX Not applicable.

1/ Data are rounded to three significant digits; may not add to totals shown.

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TABLE 3

NORTH CAROLINA: CRUSHED STONE SOLD OR USED BY PRODUCERS IN 1997, BY USE 1/ 2/

Use	Quantity (thousand metric tons)	Value (thousands)	Unit value
Coarse aggregate (+1 1/2 inch):			
Macadam	24	$172	$7.17
Riprap and jetty stone	679	7,320	10.78
Filter stone	246	2,300	9.36
Other coarse aggregate	47	384	8.17
Coarse aggregate, graded:			
Concrete aggregate, coarse	3,330	32,500	9.74
Bituminous aggregate, coarse	1,660	14,700	8.85
Bituminous surface-treatment aggregate	1,540	14,100	9.12
Railroad ballast	1,440	7,680	5.33
Other graded coarse aggregate	1,840	17,100	9.27
Fine aggregate (-3/8 inch):			
Stone sand, concrete	226	1,450	6.40
Stone sand, bituminous mix or seal	658	4,470	6.80
Screening, undesignated	1,860	13,900	7.47
Other fine aggregate	158	1,050	6.63
Coarse and fine aggregates:			
Graded road base or subbase	8,620	59,300	6.88
Unpaved road surfacing	613	3,840	6.27
Crusher run or fill or waste	697	3,820	5.48
Other coarse and fine aggregates	1,890	10,300	5.46
Other construction materials 3/	9	46	5.11
Agricultural:			
Agricultural limestone	7	40	5.71
Other agricultural uses	W	W	5.85
Special:			
Mine dusting or acid water treatment	W	W	6.80
Lightweight aggregate, slate	W	W	6.99
Unspecified: 4/			
Actual	36,600	259,000	7.07
Estimated	1,000	6,970	6.95
Total	63,700	464,000	7.28

W Withheld to avoid disclosing company proprietary data; included in "Total."

1/ Includes dolomite, granite, limestone, miscellaneous stone, quartzite, slate, traprock, and volcanic cinder and scoria.

2/ Data are rounded to three significant digits, except unit value; may not add to totals shown.

3/ Includes terrazzo and exposed aggregate.

4/ Includes reported and estimated production without a breakdown by end use.

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TABLE 4
NORTH CAROLINA: CRUSHED STONE SOLD OR USED BY PRODUCERS IN 1997,
BY USE AND DISTRICT 1/

(Thousand metric tons and thousand dollars)

Use	District 1		District 2		District 3	
	Quantity	Value	Quantity	Value	Quantity	Value
Construction aggregates:						
Coarse aggregate (+1 1/2 inch) 2/	292	2,330	440	4,600	264	3,250
Coarse aggregate, graded 3/	2,280	16,100	W	W	W	W
Fine aggregate (-3/8 inch) 4/	670	4,630	W	W	W	W
Coarse and fine aggregate 5/	2,740	17,100	W	W	W	W
Other construction materials	--	--	11,900	83,100	7,470	66,900
Agricultural 6/	7	(7/)	--	--	(8/)	(8/)
Special 9/	(7/)	(7/)	--	--	--	--
Unspecified: 10/						
Actual	2,830	19,200	20,400	147,000	(8/)	(8/)
Estimated	243	1,780	--	--	758	5,180
Total	9,060	61,200	32,700	235,000	21,900	168,000

W Withheld to avoid disclosing company proprietary data; included with "Other construction materials."
1/ Data are rounded to three significant digits; may not add to totals shown.
2/ Includes filter stone, macadam, riprap and jetty stone, and other coarse aggregate.
3/ Includes concrete aggregate (coarse), bituminous aggregate (coarse), bituminous surface-treatment aggregate, railroad ballast, and other graded coarse aggregate.
4/ Includes stone sand (concrete), stone sand (bituminous mix or seal), screening (undesignated), and other fine aggregate.
5/ Includes graded road base or subbase, terrazzo and exposed aggregate, unpaved road surfacing, crusher run (select material or fill), and other coarse and fine aggregates.
6/ Includes agricultural limestone and other agricultural uses.
7/ Less than 1/2 unit.
8/ Withheld to avoid disclosing company proprietary data; included in "Total."
9/ Includes mine dusting or acid water treatment and lightweight aggregate (slate).
10/ Includes reported and estimated production without a breakdown by end use.

TABLE 5
NORTH CAROLINA: CONSTRUCTION SAND AND GRAVEL SOLD OR USED IN 1997,
BY MAJOR USE CATEGORY 1/

Use	Quantity (thousand metric tons)	Value (thousands)	Value per ton
Concrete aggregate (including concrete sand)	3,050	$13,500	$4.43
Plaster and gunite sands	80	360	4.50
Concrete products (blocks, bricks, pipe, decorative, etc.)	372	1,510	4.05
Asphaltic concrete aggregates and other bituminous mixtures	698	2,640	3.78
Road base and coverings 2/	997	5,790	5.80
Fill	781	2,080	2.66
Snow and ice control	16	79	4.94
Other miscellaneous uses 3/	1,610	18,100	11.29
Unspecified: 4/			
Actual	2,830	13,900	4.91
Estimated	629	3,260	5.18
Total or average	11,100	61,200	5.54

1/ Data are rounded to three significant digits, except value per ton; may not add to totals shown.
2/ Includes road and other stabilization (cement).
3/ Includes filtration and railroad ballast.
4/ Includes reported and estimated production without a breakdown by end use.

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TABLE 6
NORTH CAROLINA: CONSTRUCTION SAND AND GRAVEL SOLD OR USED IN 1997,
BY USE AND DISTRICT 1/

(Thousand metric tons and thousand dollars)

Use	District 1		District 2		District 3	
	Quantity	Value	Quantity	Value	Quantity	Value
Concrete aggregate and concrete products 2/	409	2,940	1,070	4,420	2,010	8,000
Asphaltic concrete aggregate and road base materials 3/	792	5,020	388	1,230	1,300	4,250
Other miscellaneous uses 4/	171	1,000	1,140	16,500	305	731
Unspecified 5/	289	1,920	960	4,600	2,210	10,600
Total	1,660	10,900	3,570	26,700	5,820	23,600

1/ Data are rounded to three significant digits; may not add to totals shown.
2/ Includes plaster and gunite sands.
3/ Includes fill and road and other stabilization (cement).
4/ Includes filtration, railroad ballast and snow and ice control.
5/ Includes reported and estimated production without a breakdown by end use.

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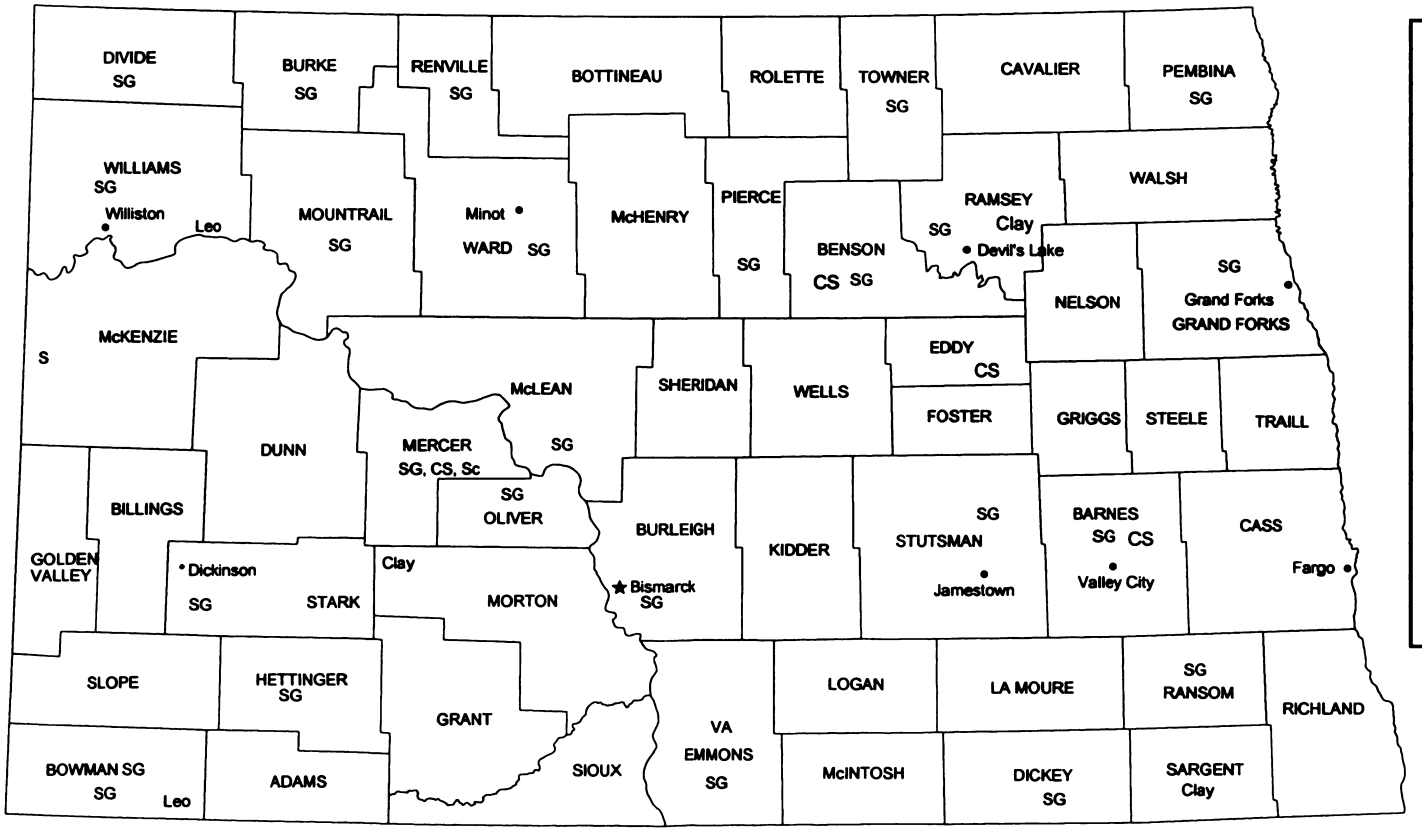
NORTH DAKOTA



LEGEND

- State boundary
- County boundary
- ★ Capital
- • City

MINERAL SYMBOLS
(Major producing areas)

Clay	Clay
CS	Crushed stone
Leo	Leonardite
S	Sulfur
Sc	Scoria
SG	Sand and gravel
VA	Volcanic ash

0 50 Kilometers

Source: North Dakota Geological Survey/U.S. Geological Survey (1998)

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THE MINERAL INDUSTRY OF NORTH DAKOTA

This chapter has been prepared under a Memorandum of Understanding between the U.S. Geological Survey and the North Dakota Geological Survey for collecting information on all nonfuel minerals.

In 1998, the preliminary estimated value[1] of nonfuel mineral production for North Dakota was $34.7 million, according to the U.S. Geological Survey (USGS). This was a 3% increase from that of 1997,[2] and followed a 9.4% increase in 1997 from that of 1996.

North Dakota's leading nonfuel mineral by value was construction sand and gravel. This high-volume, low-value commodity accounted for nearly 80% of the State's nonfuel mineral production value. In 1998, all nonfuel minerals, led by construction sand and gravel, increased in value, except gemstones, which was unchanged (table 1). Lime and industrial sand and gravel were produced in the State but the data are included in the combined values in table 1 in order to protect company proprietary data. In 1997, only construction sand and gravel showed any significant change, the increase of which accounted for most of the State's increase in value.

The following narrative information was provided by the North Dakota Geological Survey[3] (NDGS). During 1998, 18 surface mining operations were operational, as reported to the State Soil Conservation Committee (SSCC). (The SSCC collects production data by volume, unlike the USGS, which collects data by mass or metric tons produced.) Based on these reports, 115 hectares were affected. The quantity of minerals mined included 1,710,000 cubic meters of sand and gravel, 72,300 cubic meters of clay, and 42,300 cubic meters of crushed stone, 11,100 cubic meters of scoria, totaling 1,830,000 cubic meters of mineral material. From 61 pits ranging in size from more than 0.1 hectare to 16 hectares, a total of 272,000 cubic meters of overburden were disturbed.

Leonardite is an oxidized lignite. Currently, Georesources, Inc. of Williston and American Colloid Co. of Scranton are the only leonardite mining operations in North Dakota. The two companies produced a combined total of more than 34,000 metric tons of leonardite in 1998. Leonardite is processed and used as a dispersant and viscosity control in oil-well drilling muds, as a stabilizer for ion-exchange resins in water treatment, and as a soil conditioner.

The SSCC, as designated by the State legislature, continues to administer the Surface Mining Report Law, which requires any person conducting surface mining operations for minerals other than coal to comply with the reporting requirements of North Dakota Century Code Chapter 38-16. Minerals included under the law are cement rock, clay, gravel, limestone, manganese, molybdenum, peat, potash, pumicite, salt, sand, scoria, stone, sodium sulfate, zeolite, or other minerals (except coal). The SSCC has the regulatory authority to administer the reporting requirement, while the actual regulatory authority for most of these mining activities rests with the NDGS. The law requires that any person or company that within one calendar year removes 7,650 cubic meters (10,000 cubic yards) or more of earthen materials or products (including overburden) affecting 0.2 hectare (one-half acre) or more in combined mining operations must report the particulars of their surface mining activities. Some operators of smaller operations cooperate by voluntarily submitting summary reports to the SSCC, although not required to by law. Nevertheless, because not all operations report, the summary of surface mining statistics presented above is a conservative estimate of the amount of nonfuel minerals mined in North Dakota in 1998.

The North Dakota legislature, which convenes every other year, was not in session during 1998, therefore no legislative actions in the nonfuel mineral industry occurred. The 56th Legislative Assembly of North Dakota convened on January 5, 1999. House Bill 1390, which would have allowed counties to impose a surcharge on gravel operations, failed to pass by a vote of 35 to 60.

The coal gasification plant located near Beulah continued to operate an anhydrous ammonia plant. The plant, in operation since spring 1997, has the capacity to produce 1,040 tons per day of anhydrous ammonia. The plant averaged 679 tons per day during 1998 due to poor market conditions in North Dakota and the surrounding States. Total production of anhydrous ammonia in 1998 was 248,000 tons. In 1998, the gasification plant also produced more than 3.4 million liters of krypton and xenon; almost 867,000 liters (229,020 gallons) of methanol; and about 518,000 liters (136,838 gallons) of liquid nitrogen. Ammonium sulfate production from the stack gas scrubber was almost 118,000 tons in 1998.

The NDGS continued the process of entering all geologic information from its subsurface mineral program into a computerized database. This information will be used for a

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[1]The terms "nonfuel mineral production" and related "values" encompass variations in meaning, depending on the minerals or mineral products. Production may be measured by mine shipments, mineral commodity sales, or marketable production (including consumption by producers) as is applicable to the individual mineral commodity.

All 1998 USGS mineral production data published in this chapter are preliminary estimates as of February 1999 and are expected to change. Construction sand and gravel estimates are updated periodically. To obtain the most current information, please contact the appropriate USGS mineral commodity specialist. A telephone listing for the specialists may be retrieved over the Internet at http://minerals.usgs.gov/minerals/contacts/comdir.html; by using MINES FaxBack at (703) 648-4999 from a fax machine with a touch-tone handset (request Document #1000 for a telephone listing of all mineral commodity specialists); or by calling USGS information at (703) 648-4000 for the specialist's name and number. All Mineral Industry Surveys—mineral commodity, State, and country—also may be retrieved over the Internet at http://minerals.usgs.gov/minerals; facsimile copies may be obtained from MINES FaxBack.

[2]Values, percentage calculations, and rankings for 1997 may vary from the *Minerals Yearbook, Area Reports: Domestic 1997, Volume II*, owing to the revision of preliminary 1997 to final 1997 data. Data for 1998 are preliminary and expected to change, while related rankings may also be subject to change.

[3]Ann Fritz, Geologist, authored the text of State mineral industry information submitted by the North Dakota Geological Survey.

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number of purposes, including redefining the State's uranium deposits and estimating coalbed methane potential. Using information from the computerized database, Open-File Report 98-1, *The Coalbed Methane Potential of North Dakota Lignites*, was prepared. Copies may be obtained by contacting the NDGS publications clerk at (701) 328-8000.

TABLE 1
NONFUEL RAW MINERAL PRODUCTION IN NORTH DAKOTA 1/ 2/

(Thousand metric tons and thousand dollars unless otherwise specified)

Mineral	1996		1997		1998 p/	
	Quantity	Value	Quantity	Value	Quantity	Value
Clays: Common	59	W	56	W	57	W
Gemstones	NA	3	NA	3	NA	3
Sand and gravel: Construction	8,320	23,800	9,360	26,800	9,360	27,600
Combine values of other industrial minerals	XX	7,060	XX	6,890	XX	7,040
Total	XX	30,800	XX	33,700	XX	34,700

p/ Preliminary. NA Not available. W Withheld to avoid disclosing company proprietary data; value included with "Combined values" data. XX Not applicable.
1/ Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
2/ Data are rounded to three significant digits; may not add to totals shown.

TABLE 2
NORTH DAKOTA: CONSTRUCTION SAND AND GRAVEL SOLD OR USED IN 1997, BY MAJOR USE CATEGORY 1/

Use	Quantity (thousand metric tons)	Value (thousands)	Value per ton
Concrete aggregate (including concrete sand)	131	$588	$4.49
Asphaltic concrete aggregates and other bituminous mixtures	229	595	2.60
Road base and coverings 2/	2,080	4,360	2.10
Fill	185	266	1.44
Other miscellaneous uses 3/	10	82	8.20
Unspecified: 4/			
Actual	885	2,520	2.84
Estimated	5,840	18,400	3.15
Total or average	9,360	26,800	2.87

1/ Data are rounded to three significant digits; may not add to totals shown.
2/ Includes road and other stabilization (cement and lime).
3/ Includes railroad ballast and snow and ice control.
4/ Includes reported and estimated production without a breakdown by end use.

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OHIO

LEGEND

- County boundary
- ★ Capital
- • City
- 1 — Crushed stone/sand and gravel districts

MINERAL SYMBOLS (Major Producing areas)

Al	Aluminum plant	D-S	Dimension sandstone	Lime	Lime plant
CC-Sh	Common clay and shale	FC	Fire clay	Peat	Peat
Cem	Cement plant	Gyp	Gypsum	Salt	Salt
CS	Crushed stone	IS	Industrial sand	SG	Sand and gravel
D-L	Dimension limestone		Concentration of mineral operations	Steel	Iron and steel plant

Source: Ohio Division of Geological Survey/U.S. Geological Survey (1998)

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THE MINERAL INDUSTRY OF OHIO

This chapter has been prepared under a Memorandum of Understanding between the U.S. Geological Survey and the Ohio Department of Natural Resources, Division of Geological Survey, for collecting information on all nonfuel minerals.

In 1998, the preliminary estimated value[1] of nonfuel mineral production for Ohio was $1.15 billion, according to the U.S. Geological Survey (USGS). This was a more than 10.5% increase from that of 1997,[2] following an increase of nearly 7.7% from 1996 to 1997. The State ranked 12th in the Nation (13th in 1997) in total nonfuel mineral production value, of which Ohio accounted for nearly 3% of the U.S. total.

In 1998, most of Ohio' s rise in value was accounted for by substantial increases in the values of crushed stone and construction sand and gravel, up 22% and 10%, respectively (table 1). The State's other mineral commodities also increased in value except for salt, dimension stone, fire clay, and crude gypsum, which decreased (in descending order of change); gemstones remained the same. During 1997, a $106 million increase in the value of crushed stone plus smaller increases in construction sand and gravel and lime were somewhat mitigated by a 20% drop in the value of salt.

Compared with USGS estimates of the quantities produced in the other 49 States during 1998, Ohio remained 1st[2] in fire clays, 4th in crushed stone and construction sand and gravel, 5th in salt and common clays, 9th in industrial sand and gravel, and 10th in masonry cement. The State climbed to second from third in lime and was a significant producer of portland cement and dimension stone. The State's mines exclusively produce industrial minerals and coal; any metals, especially steel and aluminum, produced in the State are processed from materials received from other domestic and foreign sources. Ohio continued to be the Nation's second leading raw steel-manufacturing State with an estimated output of about 15.2 million metric tons of raw steel, as reported by the American Iron and Steel Institute. Based on USGS data, the State remained the fourth leading producer of primary aluminum in the Nation in 1998.

The Ohio Department of Natural Resources, Division of Geological Survey (DGS), provided the following narrative information.[3] Aggregate production (crushed limestone and dolomite, crushed sandstone, and sand and gravel) is expected to continue at its record-breaking level, reaching 132 million metric tons. Major projects such as the new Cleveland Browns football stadium and the Columbus Blue Jackets NHL hockey arena add to an already robust construction and road-building industry. New professional football and baseball stadiums in Cincinnati and the rebuilding of I-71 between Cleveland and Columbus during the next few years indicate a healthy aggregate industry in the near term. The National Lime and Stone Association announced plans to spend in excess of $30 million to expand its Carey limestone plant in Wyandot County. The Bowerston Shale Company completed an upgrade to its brick plant that will significantly increase output at Hanover in Licking County.

The Ohio Aggregates Association has developed a strategic plan. Important aspects of the plan include web site development, the inclusion of other industrial mineral operators in the association, and adoption of a new name (Ohio Aggregates and Industrial Minerals Association). The association moved its offices to Gahanna, OH.

Legislation and Government Programs

DGS will complete the first in a series of three-dimensional (stack unit) surficial-geology maps for the State. This map, the surficial geology of the Ohio portion of the Cincinnati/Falmouth 1:100,000 quadrangles (Open-file map no. GL-B5S), will make available detailed information on the locations of sand, gravel, clay, and peat in this heavily populated region.

The USGS and the States of Illinois, Indiana, and Kentucky have invited DGS to participate in a proposed joint investigation of industrial mineral resource availability along the Ohio River corridor. The proposed investigation would use geographic information system (GIS) technology to display the locations of aggregate resources that are not currently precluded from development because of environmental, zoning, and other land-use constraints.

Ohio House Bill 710, the proposed rewrite of the State's surface mining law, did not make it out of committee, but a court decision on the Martin Marietta Aggregates vs. Clinton County case could have a far-reaching impact on Ohio's mining industry. The court ruled that mining permits cannot be issued until all local conflicts are resolved and that the State was responsible for approximately $800,000 in attorney fees. The court decision could have an adverse impact on both new permits and amendments to existing permits.

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[1]The terms "nonfuel mineral production" and related "values" encompass variations in meaning, depending on the minerals or mineral products. Production may be measured by mine shipments, mineral commodity sales, or marketable production (including consumption by producers) as is applicable to the individual mineral commodity.

All 1998 USGS mineral production data published in this chapter are preliminary estimates as of February 1999 and are expected to change. For some mineral commodities (for example, construction sand and gravel, crushed stone, and portland cement), estimates are updated periodically. To obtain the most current information, please contact the appropriate USGS mineral commodity specialist. A telephone listing for the specialists may be retrieved over the Internet at http://minerals.usgs.gov/minerals/contacts/comdir.html; by using MINES FaxBack at (703) 648-4999 from a fax machine with a touch-tone handset (request Document #1000 for a telephone listing of all mineral commodity specialists); or by calling USGS information at (703) 648-4000 for the specialist's name and number. All Mineral Industry Surveys–mineral commodity, State, and country–also may be retrieved over the Internet at http://minerals.usgs.gov/minerals; facsimile copies may be obtained from MINES FaxBack.

[2]Values, percentage calculations, and rankings for 1997 may vary from the *Minerals Yearbook, Area Reports: Domestic 1997, Volume II*, owing to the revision of preliminary 1997 to final 1997 data. Data for 1998 are preliminary and expected to change, while related rankings may also be subject to change.

[3]David Stith, Geologist and Supervisor, and Mark Wolfe, Geologist, authored the text of Ohio mineral industry information submitted by the Division of Geological Survey.

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TABLE 1
NONFUEL RAW MINERAL PRODUCTION IN OHIO 1/ 2/

(Thousand metric tons and thousand dollars unless otherwise specified)

Mineral	1996 Quantity	1996 Value	1997 Quantity	1997 Value	1998 p/ Quantity	1998 p/ Value
Cement: Portland	W	W	1,040	76,900	W	W
Clays:						
Common	1,960	7,450	1,210	5,600	1,230	5,710
Fire	103	3,230	301	4,310	272	3,990
Gemstones	NA	153	NA	3	NA	3
Lime	1,950 r/	105,000 r/	1,960	111,000	2,030	112,000
Sand and gravel:						
Construction	46,600	215,000	47,000	222,000	50,100	244,000
Industrial	1,270	29,800	1,140	28,600	1,170	29,600
Stone:						
Crushed	63,600	291,000	74,100	397,000	80,900	485,000
Dimension metric tons	19,800	2,060	24,600	3,240	21,000	2,090
Combined values of cement (masonry), gypsum (crude), peat, salt, silica stone (1996-97), and values indicated by symbol W	XX	314,000	XX	193,000	XX	269,000
Total	XX	966,000 r/	XX	1,040,000	XX	1,150,000

p/ Preliminary. r/ Revised. NA Not available. W Withheld to avoid disclosing company proprietary data; value included with "Combined values"data. XX Not applicable.
1/ Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
2/ Data are rounded to three significant digits; may not add to totals shown.

TABLE 2
OHIO: CRUSHED STONE SOLD OR USED, BY KIND 1/

Kind	1996 Number of quarries	1996 Quantity (thousand metric tons)	1996 Value (thousands)	1996 Unit Value	1997 Number of quarries	1997 Quantity (thousand metric tons)	1997 Value (thousands)	1997 Unit Value
Limestone	83 r/	45,400 r/	$210,000 r/	$4.64 r/	94	54,900	$312,000	$5.68
Dolomite	20	15,400	63,900	4.15	20	16,100	68,000	4.23
Limestone-dolomite	6	2,790	16,000	5.73	6	3,090	17,000	5.50
Sandstone	4	42	155	3.69	4	44	197	4.48
Total	XX	63,600	291,000	4.57	XX	74,100	397,000	5.36

r/ Revised. XX Not applicable.
1/ Data are rounded to three significant digits; may not add to totals shown.

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TABLE 3

OHIO: CRUSHED STONE SOLD OR USED BY PRODUCERS IN 1997, BY USE 1/ 2/

Use	Quantity (thousand metric tons)	Value (thousands)	Unit Value
Coarse aggregate (+1 1/2 inch):			
Macadam	1	$6	$6.00
Riprap and jetty stone	657	3,440	5.24
Filter stone	107	609	5.69
Other coarse aggregate	1,490	6,090	4.10
Coarse aggregate, graded:			
Concrete aggregate, coarse	3,860	16,900	4.38
Bituminous aggregate, coarse	2,440	10,300	4.24
Bituminous surface-treatment aggregate	208	1,380	6.63
Railroad ballast	64	171	2.67
Other graded coarse aggregate	298	1,350	4.51
Fine aggregate (-3/8 inch):			
Stone sand, concrete	427	1,390	3.24
Stone sand, bituminous mix or seal	786	3,350	4.26
Screening, undesignated	280	1,250	4.46
Other fine aggregate	50	290	5.80
Coarse and fine aggregates:			
Graded road base or subbase	9,130	36,300	3.98
Unpaved road surfacing	5,260	25,400	4.82
Crusher run or fill or waste	884	2,620	2.97
Other coarse and fine aggregates	2,760	15,100	5.47
Other construction materials	186	891	4.79
Agricultural limestone	892	5440	6.10
Chemical and metallurgical:			
Cement manufacture	W	W	2.76
Flux stone	W	W	10.56
Special:			
Asphalt fillers or extenders	W	W	10.60
Whiting or whiting substitute	W	W	10.82
Building products	5	79	15.80
Other specified uses not listed	498	2,440	4.90
Unspecified: 3/			
Actual	28,400	178,000	6.26
Estimated	13,800	78,600	5.70
Total	74,100	397,000	5.36

W Withheld to avoid disclosing company proprietary data; included in "Total."

1/ Includes dolomite, limestone, limestone-dolomite, and sandstone.

2/ Data are rounded to three significant digits, except unit value; may not add to totals shown.

3/ Includes reported and estimated production without a breakdown by end use.

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TABLE 4
OHIO: CRUSHED STONE SOLD OR USED BY PRODUCERS IN 1997, BY USE AND DISTRICT 1/

(Thousand metric tons and thousand dollars)

Use	District 1		District 2		District 3	
	Quantity	Value	Quantity	Value	Quantity	Value
Construction aggregates:						
Coarse aggregate (+1 1/2 inch) 2/	1,290	5,170	W	W	213	1,300
Coarse aggregate, graded 3/	3,070	12,100	W	W	978	4,780
Fine aggregate (-3/8 inch) 4/	662	2,350	W	W	155	779
Coarse and fine aggregate 5/	10,600	42,500	W	W	2,010	10,800
Other construction materials	183	925	2,470	8,970	--	--
Agricultural 6/	422	1,900	(7/)	(7/)	(7/)	(7/)
Chemical and metallurgical 8/	611	734	--	--	(7/)	(7/)
Special 9/	498	2,440	--	--	(7/)	(7/)
Unspecified: 10/						
Actual	9,410	44,000	(7/)	(7/)	3,580	28,700
Estimated	2,220	15,900	584	2,240	3,100	16,100
Total	29,000	128,000	6,270	26,800	11,100	68,300

Use	District 4		District 5		District 6	
	Quantity	Value	Quantity	Value	Quantity	Value
Construction aggregates:						
Coarse aggregate (+1 1/2 inch) 2/	79	476	244	1,490	W	W
Coarse aggregate, graded 3/	1,280	6,830	167	1,080	W	W
Fine aggregate (-3/8 inch) 4/	W	W	125	618	W	W
Coarse and fine aggregate 5/	W	W	1,620	10,300	1,120	6,240
Other construction materials	2,260	8,430	--	--	346	1,840
Agricultural 6/	87	569	136	1,140	138	826
Chemical and metallurgical 8/	--	--	--	--	--	--
Special 9/	--	--	--	--	--	--
Unspecified: 10/						
Actual	6,900	58,600	139	984	5,150	30,000
Estimated	6,950	38,700	--	--	933	5,560
Total	17,600	114,000	2,430	15,600	7,690	44,500

W Withheld to avoid disclosing company proprietary data; included with "Other construction materials."
1/ Data are rounded to three significant digits; may not add to totals shown.
2/ Includes filter stone, macadam, riprap and jetty stone, and other coarse aggregate.
3/ Includes concrete aggregate (coarse), bituminous aggregate (coarse), bituminous surface-treatment aggregate, railroad ballast, and other graded coarse aggregate.
4/ Includes stone sand (concrete), stone sand (bituminous mix or seal), screening (undesignated), and other fine aggregate.
5/ Includes graded road base or subbase, unpaved road surfacing, crusher run (select material or fill), and other coarse and fine aggregate.
6/ Includes agricultural limestone.
7/ Withheld to avoid disclosing company proprietary data; included in "Total."
8/ Includes cement manufacture and flux stone.
9/ Includes asphalt fillers or extenders, other fillers or extenders, other specified uses not listed, and whiting or whiting substitute.
10/ Includes reported and estimated production without a breakdown by end use.

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TABLE 5
OHIO: CONSTRUCTION SAND AND GRAVEL SOLD OR USED IN 1997,
BY MAJOR USE CATEGORY 1/

Use	Quantity (thousand Metric tons)	Value (thousands)	Value per ton
Concrete aggregate (including concrete sand)	9,320	$45,400	$4.87
Plaster and gunite sands	51	292	5.73
Concrete products (blocks, bricks, pipe, decorative, etc.)	624	3,950	6.32
Asphaltic concrete aggregates and other bituminous mixtures	3,600	17,400	4.82
Road base and coverings 2/	3,110	16,900	5.42
Fill	5,260	22,200	4.22
Snow and ice control	64	304	4.75
Filtration	34	313	9.21
Other miscellaneous uses 3/	1,520	7,220	4.76
Unspecified: 4/			
Actual	17,000	79,000	4.65
Estimated	6,410	29,400	4.58
Total or average	47,000	222,000	4.73

1/ Data are rounded to three significant digits; may not add to totals shown.
2/ Includes road and other stabilization (cement).
3/ Includes railroad ballast and roofing granules.
4/ Includes reported and estimated production without a breakdown by end use.

TABLE 6
OHIO: CONSTRUCTION SAND AND GRAVEL SOLD OR USED IN 1997,
BY USE AND DISTRICT 1/

(Thousand metric tons and thousand dollars)

	District 1		District 2		District 3	
Use	Quantity	Value	Quantity	Value	Quantity	Value
Concrete aggregate	W	W	4,430	19,800	2,150	10,600
Concrete products 2/	--	--	337	1,810	190	1,700
Asphaltic concrete aggregate	W	W	1,420	6,400	712	3,530
Roadbase and coverings 3/	W	W	1,050	6,180	564	3,240
Fill	W	W	1,120	6,030	1,610	4,380
Snow and ice control	--	--	8	53	W	W
Other miscellaneous uses 4/	61	315	195	1,160	386	2,710
Unspecified: 5/						
Actual	W	W	1,460	9,060	11,100	49,000
Estimated	348	1,270	1,390	8,060	1,140	4,940
Total	1,740	8,140	11,400	58,500	17,800	80,200
	District 4		District 5		District 6	
	Quantity	Value	Quantity	Value	Quantity	Value
Concrete aggregate	1,050	4,990	1,140	7,080	W	W
Concrete products 2/	W	W	W	W	85	411
Asphaltic concrete aggregate	W	W	582	2,880	220	1,280
Roadbase and coverings 3/	W	W	823	4,070	37	199
Fill	W	W	313	1,390	W	W
Snow and ice control	W	W	23	120	W	W
Other miscellaneous uses 4/	40	184	223	1,130	644	2,040
Unspecified: 5/						
Actual	W	W	W	W	815	3,980
Estimated	774	3,360	1,310	5,130	1,460	6,610
Total	6,620	31,500	5,890	28,300	3,500	15,500

W Withheld to avoid disclosing company proprietary data; included in "Total."
1/ Data are rounded to three significant digits; may not add to totals shown.
2/ Includes plaster and gunite sands.
3/ Includes road and other stabilization (cement).
4/ Includes filtration, railroad ballast and roofing granules.
5/ Includes reported and estimated production without a breakdown by end use.

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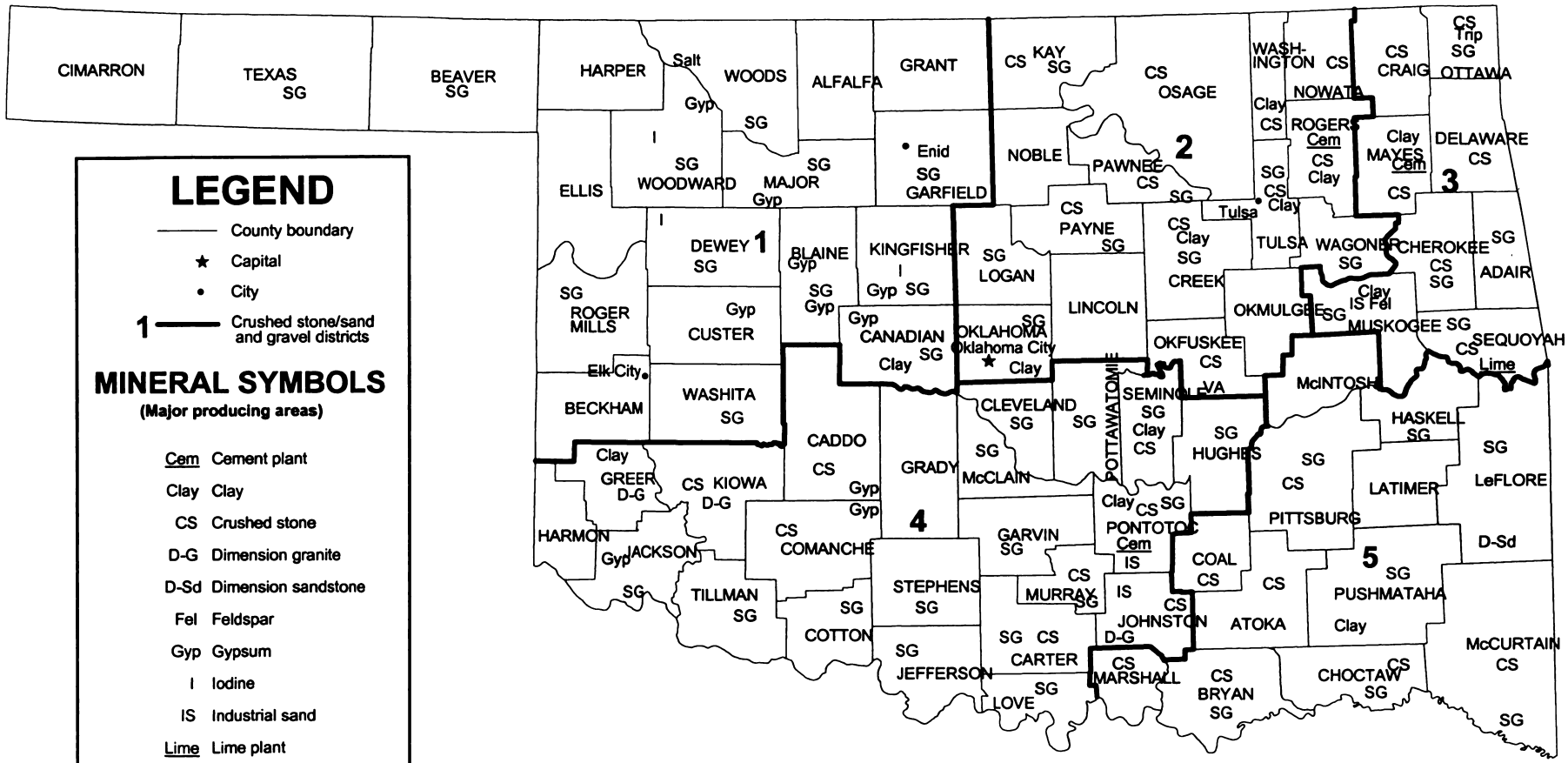
OKLAHOMA



LEGEND

- County boundary
- ★ Capital
- • City
- 1 Crushed stone/sand and gravel districts

MINERAL SYMBOLS

(Major producing areas)

Cem	Cement plant
Clay	Clay
CS	Crushed stone
D-G	Dimension granite
D-Sd	Dimension sandstone
Fel	Feldspar
Gyp	Gypsum
I	Iodine
IS	Industrial sand
Lime	Lime plant
Salt	Salt
SG	Sand and gravel
Trip	Tripoli
VA	Volcanic ash

0 50 Kilometers

Source: Oklahoma Geological Survey/U.S. Geological Survey (1998)

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THE MINERAL INDUSTRY OF OKLAHOMA

This chapter has been prepared under a Memorandum of Understanding between the U.S. Geological Survey and the Oklahoma Geological Survey for collecting information on all nonfuel minerals.

In 1998, the preliminary estimated value[1] of nonfuel mineral production for Oklahoma was $408 million, according to the U.S. Geological Survey (USGS). This was about a 6% increase from that of 1997,[2] following a 4.6% increase from 1996 to 1997. The State climbed in rank to 32d from 33d among the 50 States in total nonfuel mineral production value, of which Oklahoma accounted for 1% of the U.S. total.

In 1998, portland cement and crushed stone were Oklahoma's leading nonfuel mineral commodities, accounting for about 34% and 29%, respectively, of the State's total preliminary nonfuel mineral value. The combined values of construction materials—portland and masonry cements, crushed stone, construction sand and gravel, gypsum, and common clay, in descending order of value—accounted for almost 79% of the total value. Oklahoma's increase in value in 1998 mostly resulted from the higher values of portland cement, crude iodine, crushed stone, crude gypsum, and construction sand and gravel, in descending order of relative increase (table 1). Only feldspar, gemstones, and dimension stone showed relatively small value decreases, while industrial sand and gravel and tripoli remained at 1997 levels. Shell production for gem material declined considerably, resulting in a 92% decrease in the value of gemstones, but this had a relatively small effect on the State's overall total increase in value. In 1997, increases in portland cement, grade-A helium, and crude iodine far outweighed decreases in crushed stone, masonry cement, and salt, resulting in the State's increase for the year (table 1).

Oklahoma's mines exclusively produced industrial minerals; no metals were mined in the State. Based on USGS estimates of the quantities produced in the 50 States during 1998, Oklahoma remained the only[2] State that produced iodine, and it continued as first in crude gypsum; third of three States in crude helium; fourth of in six grade-A helium; and eighth in industrial sand and gravel. The State dropped from fourth to fifth in feldspar. Additionally, significant quantities of portland and masonry cements, crushed stone, and common clays were produced in the State.

The following narrative information was provided by the Oklahoma Geological Survey (OGS), which reported that industrial-mineral activity in the State continued to increase during 1998.[3] Overall, production has been level or rising steadily over the past several years for the following mineral commodities: crushed stone for aggregate, railroad ballast, and fill; cement for highways, housing, and commercial buildings; dimension stone for houses and commercial buildings; sand and gravel for a variety of construction projects; gypsum for wallboard and plasters; and iodine for pharmaceuticals, disinfectants, and animal feed. Construction activities that held steady or increased somewhat in 1998 were highway construction and residential and commercial building.

Crushed stone demand rose in 1998, due largely to highway construction, the need for granite and rhyolite as railroad ballast, and increased housing and commercial building construction. Most Oklahoma highways are now being built with a concrete surface, which increases the demand for cement. In 1998, Oklahoma authorized $700 million in road construction, including turnpikes and Federal and State highways.

Sand and gravel production increased in 1998. New and expanded activity is occurring in south-central and southeastern Oklahoma to help supply the Dallas–Fort Worth, TX, market area. Texas Industries, Inc. (TXI) opened a new pit on the Red River, just south of Durant in Bryan County; although TXI mines sand and gravel in Oklahoma, the material is sent by pipeline across the State line to the company's plant in Texas, owing to better and shorter highway access to the Dallas area.

According to the OGS, silica sand production (reported as industrial sand and gravel in table 1) was up significantly in 1998. U.S. Silica Co. and Unimin Corp. hydraulically mine high-purity quartz sand in the Arbuckle Mountains of south-central Oklahoma, and Arkhola Sand and Gravel Co. is dredging a feldspathic sand from the Arkansas River at Muskogee in northeast Oklahoma. These sands are used for glassmaking, foundry sands, ceramics, and the manufacture of sodium silicate.

According to OGS estimates, gypsum production slightly increased during 1998, and some companies reported a record year. Also, the price of gypsum increased moderately. The output of plasters and other industrial-gypsum products was higher than in 1997. Healthy building activity helped to keep

[1]The terms "nonfuel mineral production" and related "values" encompass variations in meaning, depending on the minerals or mineral products. Production may be measured by mine shipments, mineral commodity sales, or marketable production (including consumption by producers) as is applicable to the individual mineral commodity.

All 1998 USGS mineral production data published in this chapter are preliminary estimates as of February 1999 and are expected to change. For some mineral commodities (for example, construction sand and gravel, crushed stone, and portland cement), estimates are updated periodically. To obtain the most current information, please contact the appropriate USGS mineral commodity specialist. A telephone listing for the specialists may be retrieved over the Internet at http://minerals.usgs.gov/minerals/contacts/comdir.html; by using MINES FaxBack at (703) 648-4999 from a fax machine with a touch-tone handset (request Document #1000 for a telephone listing of all mineral commodity specialists); or by calling USGS information at (703) 648-4000 for the specialist's name and number. All Mineral Industry Surveys–mineral commodity, State, and country–also may be retrieved over the Internet at http://minerals.usgs.gov/minerals; facsimile copies may be obtained from MINES FaxBack.

[2]Values, percentage calculations, and rankings for 1997 may vary from the *Minerals Yearbook, Area Reports: Domestic 1997, Volume II*, owing to the revision of preliminary 1997 to final 1997 data. Data for 1998 are preliminary and expected to change, while related rankings may also be subject to change.

[3]Kenneth S. Johnson, Associate Director of the Oklahoma Geological Survey, authored the text of State minerals information submitted by the OGS.

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Oklahoma wallboard plants operating at near-capacity during the year, and there was little room to expand to meet the rising national and regional demand. Republic Gypsum Co. added a second board line at its plant in Duke, OK, increasing the company's capacity by another 80%.

Iodine production marginally increased during 1998, and based on USGS preliminary data (table 1), the value rose 25% above that of 1997. The price of iodine held steady at $18 to $19 per kilogram during the year, a significant increase over the $11 to $15 per kilogram price just 2 years earlier. Three companies are operating four facilities in northwest Oklahoma. The companies drilled several new producing wells during the year, and plugged several wells that were only marginally productive. Oklahoma produced about 26% of the Nation's iodine needs.

The number of mining permits in Oklahoma dropped slightly in 1998, but the acreage under permit has risen. The Oklahoma Department of Mines (ODM) issued a total of 409 permits in 1998, covering a total of about 22,000 hectares (about 55,000 acres). According to ODM, many more companies are obtaining a Life Expectancy Permit, as allowed under the State's 1994 law. Under this law, a company may submit a mining plan only once to cover the mine's life expectancy, instead of undergoing a permit review every 5 years. Of permits on file for 1998, ODM reports that 225 (55%) have been secured under the Life Expectancy provision.

ODM reported that during 1997 about 3.5 million man-hours were worked in Oklahoma's noncoal mining activities, a moderate increase over the 3.3 million man-hours worked in 1996.

Recent Federal legislation provides an accelerated depreciation for mining and other business and industry activity on former American Indian reservations in Oklahoma. A 1993 Federal law first provided for such assistance on existing reservations in the United States, but a U.S. Congressman from Oklahoma sponsored a portion of the Tax Relief Act of 1997 that extended depreciation allowances to Oklahoma lands that were within reservation boundaries just prior to opening the lands for settlement in the late 1800's and early 1900's. These former American Indian reservations comprise about two-thirds of Oklahoma.

Oklahoma hosted the 34th Forum on the Geology of Industrial Minerals on May 2–6, 1998, in Norman. This prestigious annual meeting was attended by 177 specialists in the geology, production, and marketing of a wide range of industrial minerals throughout the United States and elsewhere in the world. Attendees came from Canada, Chile, England, Greece, Turkey, and the United States. A total of 54 talks and posters were presented; they are scheduled to be published in mid-1999 in a proceedings volume. The forum was sponsored by the OGS, the ODM, the Oklahoma Mining Commission, and the USGS.

TABLE 1
NONFUEL RAW MINERAL PRODUCTION IN OKLAHOMA 1/ 2/

(Thousand metric tons and thousand dollars unless otherwise specified)

Mineral	1996		1997		1998 p/	
	Quantity	Value	Quantity	Value	Quantity	Value
Cement:						
Masonry	101	8,850 e/	89	6,500 e/	91	6,800
Portland	1,750	118,000 e/	1,900	132,000 e/	1,970	139,000
Clays:						
Common	799	4,090	653	4,430	666	4,520
Fire	23	W	--	--	--	--
Gemstones	NA	603	NA	354	NA	30
Gypsum, crude	2,690	16,500	3,100	17,500	3,080	21,500
Iodine, crude metric tons	1,270	14,600	1,320	19,600	1,340	24,500
Sand and gravel:						
Construction	7,910	27,700	8,250	29,000	8,930	32,300
Industrial	1,350	27,200	1,380	28,200	1,380	28,200
Stone:						
Crushed 3/	28,300	117,000	31,900	112,000	32,500	117,000
Dimension metric tons	9,710	2,220	5,770	995	6,180	966
Combined values of feldspar, helium, lime, salt, stone [crushed shell and traprock (1996), crushed shell, traprock, and miscellaneous (1997-98)], tripoli and values indicated by symbol W	XX	32,300	XX	35,800	XX	33,100
Total	XX	369,000	XX	386,000	XX	408,000

e/ Estimated. p/ Preliminary. NA Not available. W Withheld to avoid disclosing company proprietary data; value included with "Combined values" data. XX Not applicable.
1/ Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
2/ Data are rounded to three significant digits; may not add to totals shown.
3/ Excludes certain stones; kind and value included with "Combined values" figure.

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TABLE 2
OKLAHOMA: CRUSHED STONE SOLD OR USED, BY KIND 1/

Kind	1996 Number of quarries	1996 Quantity (thousand metric tons)	1996 Value (thousands)	1996 Unit value	1997 Number of quarries	1997 Quantity (thousand metric tons)	1997 Value (thousands)	1997 Unit value
Limestone	45	21,500 r/	$84,400 r/	$3.93 r/	41	24,300	$75,600	$3.10
Dolomite	4 r/	2,400 r/	10,600 r/	4.43 r/	4	2,950	13,300	4.49
Granite	3	1,930	9,940	5.15	3	1,770	9,840	5.57
Traprock	1	(2/)	(2/)	(2/)	1	(2/)	(2/)	(2/)
Sandstone	7 r/	2,420	11,900	4.93	7	2,820	13,400	4.75
Shell	2	(2/)	(2/)	(2/)	2	(2/)	(2/)	(2/)
Slate	(3/)	(3/)	(3/)	(3/)	--	--	--	--
Miscellaneous stone	1	91	402	4.42	1	(2/)	(2/)	(2/)
Total	XX	28,300 r/	117,000	4.14	XX	31,900	112,000	3.52

r/ Revised. XX Not applicable.
1/ Data are rounded to three significant digits; may not add to totals shown.
2/ Excluded from State total to avoid disclosing company proprietary data.
3/ Revised to zero.

TABLE 3
OKLAHOMA: CRUSHED STONE SOLD OR USED BY PRODUCERS
IN 1997, BY USE 1/ 2/

Use	Quantity (thousand metric tons)	Value (thousands)	Unit value
Coarse aggregate (+1 1/2 inch):			
Riprap and jetty stone	462	$1,360	$2.95
Filter stone	68	361	5.31
Other coarse aggregate	93	724	7.78
Coarse aggregate, graded:			
Concrete aggregate, coarse	3,780	16,000	4.23
Bituminous aggregate, coarse	365	2,070	5.68
Bituminous surface-treatment aggregate	616	3,410	5.54
Other graded coarse aggregate 3/	2,010	10,200	5.09
Fine aggregate (-3/8 inch):			
Stone sand, concrete	134	198	1.48
Stone sand, bituminous mix or seal	456	2,150	4.72
Screening, undesignated	6,080	11,000	1.81
Other fine aggregate	369	1,420	3.85
Coarse and fine aggregates:			
Graded road base or subbase	1,530	6,010	3.92
Unpaved road surfacing	W	W	3.75
Crusher run or fill or waste	4,970	12,200	2.45
Other coarse and fine aggregates	934	4,910	5.26
Other construction materials 4/	366	1,270	3.46
Agricultural:			
Agricultural limestone	119	446	3.75
Poultry grit and mineral food	(5/)	(5/)	4.15
Chemical and metallurgical:			
Cement manufacture	(5/)	(5/)	2.83
Lime manufacture	(5/)	(5/)	4.15
Chemical stone	(5/)	(5/)	4.14
Sulfur oxide removal	394	1,800	4.57
Special: Other fillers or extenders	(5/)	(5/)	6.61
Unspecified: 6/			
Actual	5,300	22,600	4.26
Estimated	1,600	6,420	4.03
Total	31,900	112,000	3.52

W Withheld to avoid disclosing company proprietary data; included with "Other construction materials."
1/ Includes dolomite, granite, limestone and sandstone; excludes miscellaneous stone, shell and traprock from State total to avoid disclosing company proprietary data.
2/ Data are rounded to three significant digits; may not add to totals shown.
3/ Includes railroad ballast.
4/ Includes unpaved road surfacing.
5/ Withheld to avoid disclosing company proprietary data; included in "Total."
6/ Includes reported and estimated production without a breakdown by end use.

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TABLE 4
OKLAHOMA: CRUSHED STONE SOLD OR USED BY PRODUCERS IN 1997, BY USE AND DISTRICT 1/ 2/ 3/

(Thousand metric tons and thousand dollars)

Use	District 2		District 3		District 4		District 5	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
Construction aggregates:								
Coarse aggregate (+1 1/2 inch) 4/	128	871	W	W	W	W	117	808
Coarse aggregate, graded 5/	1,490	8,170	W	W	W	W	2,240	10,700
Fine aggregate (-3/8 inch) 6/	507	1,570	W	W	W	W	530	1,790
Coarse and fine aggregate 7/	2,090	8,010	491	9,400	3,130	5,600	1,950	8,550
Other construction materials	--	--	222	1,170	10,000	28,100	(8/)	(8/)
Agricultural 9/	32	144	(8/)	(8/)	--	--	(8/)	(8/)
Chemical and metallurgical 10/	(8/)	(8/)	(8/)	(8/)	(8/)	(8/)	394	1,800
Special 11/	--	--	--	--	(8/)	(8/)	--	--
Unspecified: 12/								
Actual	(8/)	(8/)	2,090	6,770	(8/)	(8/)	(8/)	(8/)
Estimated	71	107	21	86	522	2,160	981	4,070
Total	8,170	35,300	3,070	10,800	14,100	36,800	6,560	29,200

W Withheld to avoid disclosing company proprietary data; included with "Other construction materials."
1/ No crushed stone was produced in District 1.
2/ Excludes miscellaneous stone, shell, and traprock from State total to avoid disclosing company proprietary data.
3/ Data are rounded to three significant digits; may not add to totals shown.
4/ Includes filter stone, riprap and jetty stone, and other coarse aggregate.
5/ Includes concrete aggregate (coarse), bituminous aggregate (coarse), bituminous surface-treatment aggregate, railroad ballast, and other graded coarse aggregate.
6/ Includes stone sand (concrete), stone sand (bituminous mix or seal), screening (undesignated), and other fine aggregate.
7/ Includes graded road base or subbase, unpaved road surfacing, crusher run (select material or fill), and other coarse and fine aggregates.
8/ Withheld to avoid disclosing company proprietary data; included in "Total."
9/ Includes agricultural limestone, poultry grit, and mineral food.
10/ Includes cement manufacture, chemical stone, lime manufacture, and sulfur oxide removal.
11/ Includes other fillers or extenders.
12/ Includes reported and estimated production without a breakdown by end use.

TABLE 5
OKLAHOMA: CONSTRUCTION SAND AND GRAVEL SOLD OR USED IN 1997,
BY MAJOR USE CATEGORY 1/

Use	Quantity (thousand metric tons)	Value (thousands)	Value per ton
Concrete aggregate (including concrete sand) 2/	3,470	$13,900	$4.02
Concrete products (blocks, bricks, pipe, decorative, etc.)	44	209	4.75
Asphaltic concrete aggregates and other bituminous mixtures	272	720	2.65
Road base and coverings 3/	266	867	3.26
Fill	1,010	1,910	1.89
Other miscellaneous uses	2	33	13.32
Unspecified: 4/			
Actual	1,650	6,240	3.79
Estimated	1,540	5,090	3.30
Total or average	8,250	29,000	3.51

1/ Data are rounded to three significant digits, except value per ton; may not add to totals shown.
2/ Includes plaster and gunite sands.
3/ Includes road and other stabilization (lime) and snow and ice control.
4/ Includes reported and estimated production without a breakdown by end use.

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TABLE 6
OKLAHOMA: CONSTRUCTION SAND AND GRAVEL SOLD OR USED IN 1997,
BY USE AND DISTRICT 1/

(Thousand metric tons and thousand dollars)

Use	District 1		District 2	
	Quantity	Value	Quantity	Value
Concrete aggregate and concrete products 2/	726	2,460	1,290	4,380
Asphaltic concrete aggregates and road base materials 3/	220	825	208	555
Fill	149	409	693	1,270
Other miscellaneous uses	2	33	--	--
Unspecified 4/	322	1,200	930	2,550
Total	1,420	4,920	3,120	8,760
	District 4		Districts 3 and 5	
	Quantity	Value	Quantity	Value
Concrete aggregate and concrete products 3/	1,040	4,960	456	2,350
Asphaltic concrete aggregates and road base materials 4/	W	W	W	W
Fill	W	W	W	W
Other miscellaneous uses	--	--	--	--
Unspecified 4/	998	4,270	937	3,310
Total	2,250	9,560	1,460	5,770

W Withheld to avoid disclosing company proprietary data; included in "Total."
1/ Data are rounded to three significant digits; may not add to totals shown.
2/ Includes plaster and gunite sands.
3/ Includes road and other stabilization (lime) and snow and ice control.
4/ Includes reported and estimated production without a breakdown by end use.

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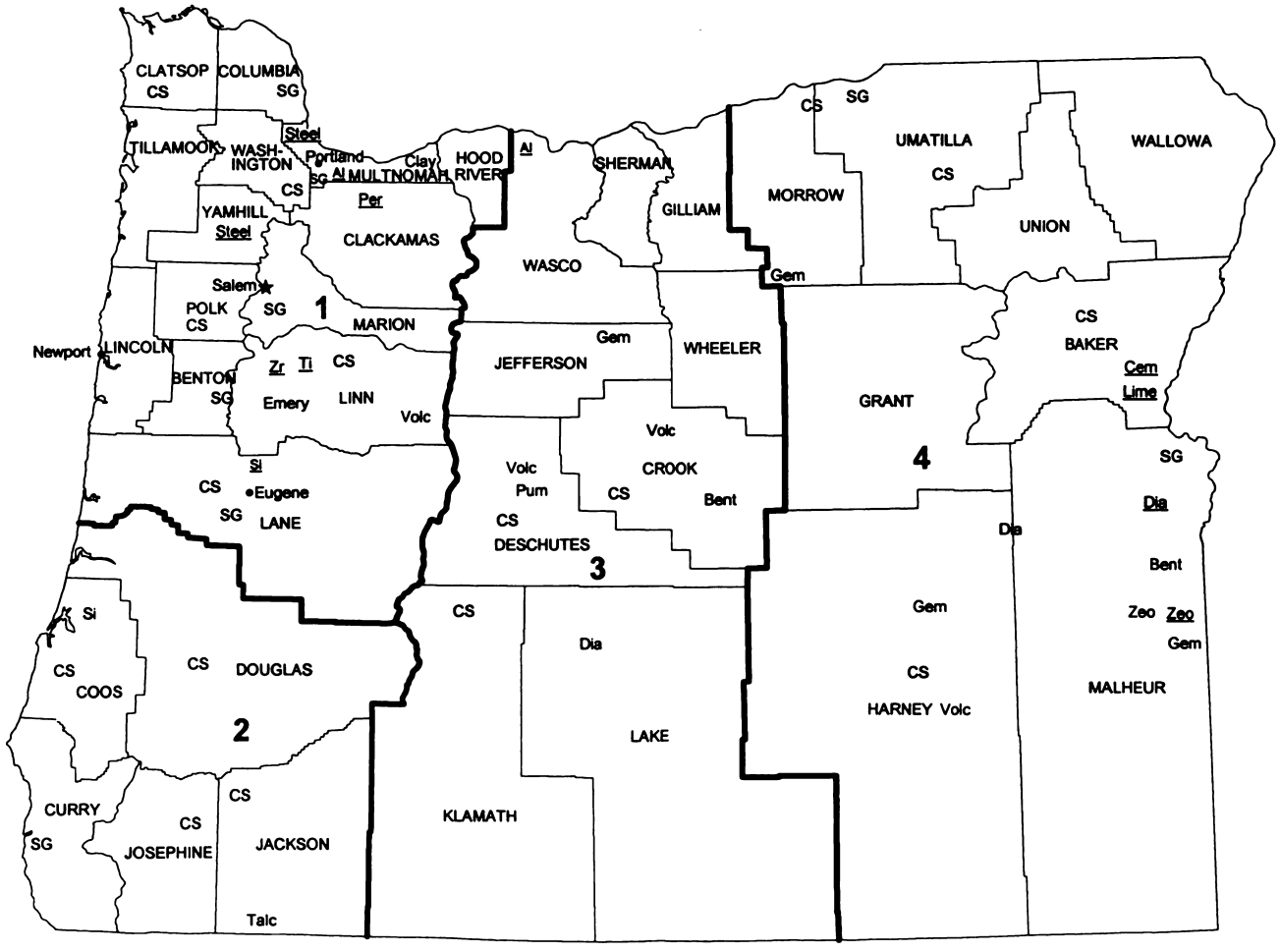
OREGON



LEGEND

- County boundary
- Capital
- City
- 1 — Crushed stone/sand and gravel districts

MINERAL SYMBOLS

(Major producing areas)

Al	Aluminum plant
Bent	Bentonite
Cem	Cement plant
Clay	Clay
CS	Crushed stone
Dia	Diatomite
Dia	Diatomite plant
Emery	Emery
Gem	Gemstone
Lime	Lime plant
Per	Perlite plant
Pum	Pumice
SG	Sand and gravel
Si	Silica
Si	Silicon plant
Steel	Steel plant
Talc	Talc minerals
Ti	Titanium plant
Volc	Volcanic cinders
Zeo	Zeolites
Zeo	Zeolite plant
Zr	Zirconium plant

0 50 Kilometers

Source: Oregon Department of Geology and Mineral Industries/U.S. Geological Survey (1998)

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THE MINERAL INDUSTRY OF OREGON

In 1998, the estimated value[1] of nonfuel mineral production for Oregon was $272 million, according to the U.S. Geological Survey (USGS). This was about a 5% decrease from that of 1997,[2] and followed a 7.1% increase in 1997 over that of 1996.

Industrial minerals accounted for all of Oregon's nonfuel mineral production. Crushed stone and construction sand and gravel, by value, remained Oregon's two leading nonfuel mineral commodities in 1998, together accounting for more than 69% of the State's total. In 1998, decreases in the values of crushed stone and construction sand and gravel together were more than double the total of the increases that occurred in diatomite, portland cement, and fuller's earth (listed from largest to smallest amount of change), resulting in Oregon's net decrease for the year (table 1). All other minerals had relatively small increases except bentonite and crude perlite that had similarly small decreases. In 1997, significant increases in the production values of construction sand and gravel, crushed stone, and portland cement led the State to a net gain over the preceding year. A decline in gemstone mining occurred during 1997, when a producer continued to sell 1996 output and reduce mine operations.

The Glenbrook Nickel Company, a joint venture of Cominco American Inc. and Cominco Resources International Ltd., permanently closed the Nickel Mountain Mine near Riddle, OR, and its adjoining smelter on March 31, 1998. Nickel Mountain had been idle and on a care-and-maintenance basis since 1996 because of low prices for nickel ore. The Nickel Mountain ore has a significantly lower nickel content than several ores being mined elsewhere in the Pacific region. The mine had been the sole domestic producer of primary nickel in the United States in recent years, operating on an intermittent basis—mine production depending on the price of nickel. Glenbrook operated its smelter in Riddle at full capacity during 1997, processing mostly garneritic laterite ore from Société Minière du Sud Pacifique of New Caledonia. During the first 3 months of 1998, the smelter produced 8,700 metric tons of ferronickel containing about 4,290 tons of nickel. The closure of the complex left almost 300 employees without jobs. The outlook for the smelter is uncertain.

Based on USGS estimates of the quantities of raw minerals produced in the United States during 1998, Oregon remained the only[2] State to produce emery; first among six States that produce pumice and pumicite; third in diatomite and zeolites; and fourth in crude perlite. The State rose in rank to fifth from sixth in gemstones (by value) and produced significant quantities of construction sand and gravel and crushed stone.

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[1]The terms "nonfuel mineral production" and related "values" encompass variations in meaning, depending on the minerals or mineral products. Production may be measured by mine shipments, mineral commodity sales, or marketable production (including consumption by producers) as is applicable to the individual mineral commodity.

All 1998 USGS mineral production data published in this chapter are preliminary estimates as of February 1999 and are expected to change. For some mineral commodities (for example, construction sand and gravel, crushed stone, and portland cement), estimates are updated periodically. To obtain the most current information, please contact the appropriate USGS mineral commodity specialist. A telephone listing for the specialists may be retrieved over the Internet at http://minerals.usgs.gov/minerals/contacts/comdir.html; by using MINES FaxBack at (703) 648-4999 from a fax machine with a touch-tone handset (request Document #1000 for a telephone listing of all mineral commodity specialists); or by calling USGS information at (703) 648-4000 for the specialist's name and number. All Mineral Industry Surveys—mineral commodity, State, and country—also may be retrieved over the Internet at http://minerals.usgs.gov/minerals; facsimile copies may be obtained from MINES FaxBack.

[2]Values, percentage calculations, and rankings for 1997 may vary from the *Minerals Yearbook, Area Reports: Domestic 1997, Volume II*, owing to the revision of preliminary 1997 to final 1997 data. Data for 1998 are preliminary and expected to change, while related rankings may also be subject to change.

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TABLE 1
NONFUEL RAW MINERAL PRODUCTION IN OREGON 1/ 2/

(Thousand metric tons and thousand dollars unless otherwise specified)

Mineral		1996 Quantity	1996 Value	1997 Quantity	1997 Value	1998 p/ Quantity	1998 p/ Value
Clays:							
Bentonite		33	1,530	W	W	W	W
Common		213	154	W	W	W	W
Gemstones		NA	6,730	NA	980	NA	1,300
Nickel ore 3/	metric tons	1,330	W	--	--	--	--
Sand and gravel: Construction		18,300	86,800	19,100	100,00	16,600	89,700
Stone: Crushed		22,000	102,00	21,200	110,00	19,700	98,500
Talc and pyrophyllite	metric tons	64	84	W	W	W	W
Zeolites	do.	(4/)	NA	(4/)	NA	NA	NA
Combined values of cement [masonry (1997-98), portland], clays (fuller's earth), diatomite, emery, lime, perlite [crude (1997-98)], pumice and pumicite, and values indicated by symbol W		XX	68,700 r/	XX	74,100	XX	82,600
Total		XX	266,00 r/	XX	285,00	XX	272,000

p/ Preliminary. r/ Revised. NA Not available. W Withheld to avoid disclosing company proprietary data; value included with "Combined value" data. XX Not applicable.
1/ Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
2/ Data are rounded to three significant digits; may not add to totals shown.
3/ There was no production at the Nickel Mountain Mine near Riddle, OR, in 1998. The mine has been idle and on a care-and-maintenance basis since 1996 because of disappointing prices for nickel ore. The Glenbrook Nickel Company permanently closed the mine and adjoining smelter on March 31, 1998.
4/ Withheld to avoid disclosing company proprietary data.

TABLE 2
OREGON: CRUSHED STONE SOLD OR USED, BY KIND 1/

Kind	1996 Number of quarries	1996 Quantity (thousand metric tons)	1996 Value (thousands)	1996 Unit value	1997 Number of quarries	1997 Quantity (thousand metric tons)	1997 Value (thousands)	1997 Unit value
Limestone	1	W	W	W	1	W	W	W
Granite	27	70	$306	$4.37	2	29	$146	$5.03
Traprock	288	19,700	91,000	4.61	158	19,100	98,800	5.16
Sandstone and quartzite	18 r/	389	1,770	4.56	17	322	1,480	4.61
Volcanic cinder and scoria	50	35	221	6.31	--	--	--	--
Shell	1	W	W	W	1	W	W	W
Miscellaneous stone	34 r/	566 r/	2,840 r/	5.01	10	611	3,080	5.04
Total	XX	22,000	102,000	4.65	XX	21,200	110,000	5.19

r/ Revised. W Withheld to avoid disclosing company proprietary data; included in "Total." XX Not applicable.
1/ Data are rounded to three significant digits; may not add to totals shown.

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TABLE 3
OREGON: CRUSHED STONE SOLD OR USED BY PRODUCERS IN 1997, BY USE 1/ 2/

Use	Quantity (thousand metric tons)	Value (thousands)	Unit value
Coarse aggregate (+1 1/2 inch):			
Macadam	111	$400	$3.60
Riprap and jetty stone	286	1,220	4.25
Filter stone	71	456	6.42
Other coarse aggregate	18	60	3.33
Coarse aggregate, graded:			
Concrete aggregate, coarse	357	1,860	5.20
Bituminous aggregate, coarse	744	4,150	5.58
Bituminous surface-treatment aggregate	62	409	6.60
Railroad ballast	503	3,420	6.80
Other graded coarse aggregate	119	533	4.48
Fine aggregate (-3/8 inch):			
Stone sand, bituminous mix or seal	223	1,520	6.79
Screening, undesignated	19	76	4.00
Other fine aggregate 3/	64	362	5.66
Coarse and fine aggregates:			
Graded road base or subbase	5,950	34,200	5.75
Unpaved road surfacing	1,230	6,220	5.07
Crusher run or fill or waste	2,090	9,100	4.35
Drain fields	2	11	5.50
Other coarse and fine aggregates	1,700	7,770	4.56
Other construction materials	11	58	5.27
Chemical and metallurgical: Cement manufacture	W	W	W
Other miscellaneous uses: Sugar refining	W	W	W
Unspecified: 4/			
Actual	2,340	11,300	4.83
Estimated	4,520	21,400	4.73
Total	21,200	110,000	5.17

W Withheld to avoid disclosing company proprietary data; included in "Total."
1/ Includes granite, limestone, miscellaneous stone, sandstone and quartzite, shell, slate, traprock, and volcanic cinder and scoria.
2/ Data are rounded to three significant digits; may not add to totals shown.
3/ Includes stone sand (concrete).
4/ Includes reported and estimated production without a breakdown by end use.

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TABLE 4
OREGON: CRUSHED STONE SOLD OR USED BY PRODUCERS IN 1997, BY USE AND DISTRICT 1/

(Thousand metric tons and thousand dollars)

Use	District 1		District 2		District 3	
	Quantity	Value	Quantity	Value	Quantity	Value
Construction aggregates:						
Coarse aggregate (+1 1/2 inch) 2/	340	1,460	97	428	37	189
Coarse aggregate, graded 3/	757	4,410	15	67	284	1,970
Fine aggregate (-3/8 inch) 4/	161	987	--	--	W	W
Coarse and fine aggregate 5/	7,110	38,300	2,320	10,800	884	5,600
Other construction materials 6/	--	--	13	69	--	--
Chemical and metallurgical 7/	--	--	--	--	--	--
Other miscellaneous uses 8/	--	--	--	--	--	--
Unspecified: 9/						
Actual	1,660	9,390	15	59	W	W
Estimated	3,560	17,500	326	873	337	1,480
Total	13,600	72,000	2,780	12,300	1,620	9,680

	District 4		Unspecified districts	
	Quantity	Value	Quantity	Value
Construction aggregates:				
Coarse aggregate (+1 1/2 inch) 2/	11	60	--	--
Coarse aggregate, graded 3/	730	3,920	--	--
Fine aggregate (-3/8 inch) 4/	W	W	--	--
Coarse and fine aggregate 5/	659	2,590	--	--
Other construction materials 6/	--	--	--	--
Chemical and metallurgical 7/	W	W	--	--
Other miscellaneous uses 8/	W	W	--	--
Unspecified: 9/				
Actual	--	--	643	1,730
Estimated	61	314	239	1,240
Total	2,360	12,800	882	2,980

W Withheld to avoid disclosing company proprietary data; included in "Total."
1/ Data are rounded to three significant digits; may not add to totals shown.
2/ Includes filter stone, macadam, riprap and jetty stone, and other coarse aggregate.
3/ Includes concrete aggregate (coarse), bituminous aggregate (coarse), bituminous surface-treatment aggregate, railroad ballast, and other graded coarse aggregate.
4/ Includes stone sand (concrete), stone sand (bituminous mix or seal), screening (undesignated), and other fine aggregate.
5/ Includes graded road base or subbase, unpaved road surfacing, crusher run (select material or fill), and other coarse and fine aggregates.
6/ Includes drain fields.
7/ Includes cement manufacture.
8/ Includes sugar refining and other specified uses not listed.
9/ Includes reported and estimated production without a breakdown by end use.

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TABLE 5
OREGON: CONSTRUCTION SAND AND GRAVEL SOLD OR USED IN 1997,
BY MAJOR USE CATEGORY 1/

Use	Quantity (thousand metric tons)	Value (thousands)	Value per ton
Concrete aggregate (including concrete sand)	4,600	$22,500	$4.89
Plaster and gunite sands	3	$42	14.00
Asphaltic concrete aggregates and other bituminous mixtures	1,400	9,750	6.95
Road base and coverings 2/	3,260	16,000	4.91
Fill	599	2,230	3.73
Snow and ice control	22	150	6.82
Railroad ballast	3	16	5.33
Other miscellaneous uses	826	5,160	6.25
Unspecified: 3/			
Actual	4,440	25,900	5.83
Estimated	3,930	18,600	4.74
Total or average	19,100	100,000	5.26

1/ Data are rounded to three significant digits, except value per ton; may not add to totals shown.
2/ Includes road and other stabilization (lime).
3/ Includes reported and estimated production without a breakdown by end use.

TABLE 6
OREGON: CONSTRUCTION SAND AND GRAVEL SOLD OR USED IN 1997, BY USE AND DISTRICT 1/

(Thousand metric tons and thousand dollars)

	District 1		District 2		District 3	
Use	Quantity	Value	Quantity	Value	Quantity	Value
Concrete aggregates (including concrete sand) 2/	3,640	16,900	605	3,620	200	1,110
Asphaltic concrete aggregates and other bituminous mixtures	981	6,860	421	2,890	--	--
Road base materials 3/	2,300	12,000	656	2,750	128	542
Fill	463	1,700	117	469	6	31
Other miscellaneous uses 4/	63	945	746	4,170	3	28
Unspecified 5/	7,270	39,600	138	395	38	62
Total	14,700	78,000	2,680	14,300	375	1,770

	District 4		Unspecified districts	
	Quantity	Value	Quantity	Value
Concrete aggregates (including concrete sand) 2/	163	879	--	--
Asphaltic concrete aggregates and other bituminous mixtures	--	--	--	--
Road base materials 3/	172	690	--	--
Fill	13	37	--	--
Other miscellaneous uses 4/	39	186	--	--
Unspecified 5/	612	2,970	313	1,530
Total	999	4,760	313	1,530

1/ Data are rounded to three significant digits; may not add to totals shown.
2/ Includes plaster and gunite sands.
3/ Includes road and other stabilization (lime).
4/ Includes railroad ballast and snow and ice control.
5/ Includes reported and estimated production without a breakdown by end use.

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PENNSYLVANIA

LEGEND

- County boundary
- ★ Capital
- • City
- 1 — Crushed stone/sand and gravel districts

MINERAL SYMBOLS

CC-Sh	Common clay and shale
Cem	Cement plant
CS	Crushed stone
D-G	Dimension granite
D-Sd	Dimension sandstone
D-SL	Dimension slate
IS	Industrial sand
Lime	Lime plant
Mica	Mica
Peat	Peat
SG	Sand and gravel

(Major producing areas)

Steel	Iron and steel plant
Zn	Zinc plant
( )	Concentration of mineral operations

Source: Pennsylvania Bureau of Topographic and Geologic Survey/U.S. Geological Survey (1998)

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THE MINERAL INDUSTRY OF PENNSYLVANIA

This chapter has been prepared under a Memorandum of Understanding between the U.S. Geological Survey and the Pennsylvania Bureau of Topographic and Geologic Survey for collecting information on all nonfuel minerals.

In 1998, the preliminary estimated value[1] of nonfuel mineral production for Pennsylvania was $1.28 billion, according to the U.S. Geological Survey (USGS). This was about a 7% increase from that of 1997,[2] and followed a 2.6% increase in 1997 from that of 1996. For the third consecutive year, the State ranked 11th in the Nation in nonfuel mineral production value, of which Pennsylvania accounted for more than 3% of the U.S. total.

Pennsylvania continued to be among the Nation's leading States that produce crushed stone, portland cement, lime, and masonry cement (by descending order of value); these four commodities accounted for close to 90% of the State's total nonfuel mineral production value. In 1998, most minerals increased in value, led by crushed stone with a $28 million gain, portland cement up by $25 million, and construction sand and gravel with an increase of almost $19 million (table 1). Smaller yet significant gains occurred for dimension stone and masonry cement. The values of kaolin, peat, and gemstones were unchanged. In 1997, an increase of $18 million in the value of crushed stone and smaller increases in masonry cement, construction sand and gravel, and portland cement (descending order of magnitude of change) accounted for most of the year's increase.

Based on USGS estimates of the quantities produced in the 50 States in 1998, Pennsylvania remained third[2] in portland cement; fourth of four States that produce tripoli; and fifth in lime and masonry cement. While the State rose to fourth from seventh in dimension stone, it dropped to second from first in crushed stone. Additionally, significant quantities of construction and industrial sand and gravel and common clays were produced in the State (descending order of value).

Pennsylvania is exclusively an industrial mineral- and coal-producing State; metals that were produced in the State in 1998, especially steel, were processed from materials acquired from foreign and other domestic sources. Pennsylvania continued to be the Nation's third leading raw steel-manufacturing State with an estimated output of almost 7.4 million metric tons of raw steel, as reported by the American Iron and Steel Institute.

The following narrative information was provided by the Pennsylvania Bureau of Topographic and Geologic Survey[3] (PBTGS). A group of investors from Texas through a subsidiary in Virginia submitted a noncoal surface mine application to solution mine subsurface Salina salt beds in Tioga County (extreme northeastern/north central Pennsylvania) to create a gas storage facility. The salt will be mined leaving caverns for gas storage at depths exceeding several thousand feet. Based on the initial mining permit application, more than 810 hectares would be affected. Although company plans were not finalized, indications to the PBTGS were that some coarse salt would be recovered and marketed from the solution brines.

More than 2,000 hectares in new industrial mineral mining applications (not including the Tioga County solution-mining venture) were submitted to the Department of Environmental Protection (DEP). Many of these applications were for the expansion of nearby pits, quarries, and mines. Forty-eight percent of these applications were for carbonate properties, especially in the aggregate poor bituminous coal areas of western Pennsylvania. The cement industry of western Pennsylvania has been consolidating its mining operations, mostly through permit transfers. These operations produce crushed stone from relatively thin Carboniferous-age limestones and also produce incidental coal that can be used for kiln fuel. In central Pennsylvania, near two active operations and an existing lime plant, the thicker, high-calcium, Ordovician-age limestones accounted for potential underground mine expansions involving nearly 200 hectares.

More than 30% of the new aggregate applications (more than 365 hectares) represent sandstone operations in the eastern half of the State. The counties of Schuylkill and Berks in the moderately populated east-central portion of Pennsylvania accounted for more than 80% of this acreage. The PBTGS anticipated that much of this sandstone likely would be marketed for high friction road usage in populated areas. Regarding sand and gravel, generally located behind the glacial boundaries in the northwestern and northeastern portions of the State, 10 operators applied to mine on nearly 200 hectares, 70% of which occurred in northwestern Pennsylvania.

Expansions of or near existing aggregate and chemical operations were more common than "grass roots" ventures,

[1]The terms "nonfuel mineral production" and related "values" encompass variations in meaning, depending on the minerals or mineral products. Production may be measured by mine shipments, mineral commodity sales, or marketable production (including consumption by producers) as is applicable to the individual mineral commodity.

All 1998 USGS mineral production data published in this chapter are preliminary estimates as of February 1999 and are expected to change. For some mineral commodities (for example, construction sand and gravel, crushed stone, and portland cement), estimates are updated periodically. To obtain the most current information, please contact the appropriate USGS mineral commodity specialist. A telephone listing for the specialists may be retrieved over the Internet at http://minerals.usgs.gov/minerals/contacts/comdir.html; by using MINES FaxBack at (703) 648-4999 from a fax machine with a touch-tone handset (request Document #1000 for a telephone listing of all mineral commodity specialists); or by calling USGS information at (703) 648-4000 for the specialist's name and number. All Mineral Industry Surveys—mineral commodity, State, and country—also may be retrieved over the Internet at http://minerals.usgs.gov/minerals; facsimile copies may be obtained from MINES FaxBack.

[2]Values, percentage calculations, and rankings for 1997 may vary from the *Minerals Yearbook, Area Reports: Domestic 1997, Volume II*, owing to the revision of preliminary 1997 to final 1997 data. Data for 1998 are preliminary and expected to change, while related rankings may also be subject to change.

[3]Samuel W. Berkheiser, Jr., Chief of the Geological Resources Division, authored the text of State mineral industry information submitted by the Pennsylvania Bureau of Topographic and Geologic Survey.

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however, both existed and opportunities in general were materials industry appeared to be reaching another cycle of significant activity. The United States' largest construction aggregates firm, Vulcan Materials Co., initiated modest plans to set up a crushing operation in an existing southern Pennsylvania refractory producer's quarry. The PBTGS anticipated that this symbiotic relationship between an aggregate producer and a chemical stone producer would likely affect a competitive portion of the market. Visibility of the bluestone/flagstone dimension stone industry of northeastern Pennsylvania was increasing, possibly owing more to the availability and requirement of relatively new "small general permit applications" than to an actual increase in the number of operations. Applications for nearly 90 new small quarries were filed with Susquehanna County in 1998, accounting for more than 60% of the new permit applications. (Ninety-seven percent was for "bluestone" (flagstone) operations in the extreme northeastern portion of the State.) This was largely the result of a new initiative of the State plentiful. Consolidation and integration of the construction government regulatory body that enables small 0.4- to 0.8-hectare operations to apply for a simplified "General Small Noncoal Mining Permit." Nevertheless, the total known permitted "bluestone" quarries in Pennsylvania are close to 200 operations. These quarries are supported largely by the demand for natural paving materials in the populated portion of the Mid-Atlantic States having popular traditional colonial architecture. Elsewhere in the eastern part of the State, three dimension stone producers filed for small (less than 2 hectares [5 acres]) sandstone and quartzite mining permits in colluvium and bedrock.

The Pennsylvania Aggregates and Concrete Association presented the prestigious Associates Recognition Award for 1998 to the Western Division of Eastern Industries and State Aggregates. Criteria for bestowing this award include, but are not limited to reclamation, beautification, public service, community relations, and education projects, as well as any other action that is a credit to the producer and the industry.

TABLE 1
NONFUEL RAW MINERAL PRODUCTION IN PENNSYLVANIA 1/ 2/

(Thousand metric tons and thousand dollars unless otherwise specified)

Mineral	1996		1997		1998 p/	
	Quantity	Value	Quantity	Value	Quantity	Value
Cement:						
Masonry	274	28,000 e/	296	31,000 e/	301	32,600
Portland	5,670	418,000 e/	6,360	420,000 e/	6,590	445,000
Clays:						
Common	753	2,420	839	2,740	856	2,800
Kaolin	14	815	W	W	W	W
Gemstones	NA	1	NA	1	NA	1
Lime	1,530	105,000	1,510	103,000	1,570	103,000
Peat	4	166	3	126	W	W
Sand and gravel: Construction	15,100	85,600	15,700	88,500	18,400	107,000
Stone:						
Crushed	87,400	518,000	89,200	536,000	90,900	564,000
Dimension metric tons	54,300	11,800	53,900	10,800	89,100	15,700
Combined values of other industrial minerals	XX	(3/)	XX	10,700	XX	10,800
Total	XX	1,170,000 4/	XX	1,200,000	XX	1,280,000

e/ Estimated. p/ Preliminary. NA Not available. W Withheld to avoid disclosing company proprietary data; value included with "Combined values" data. XX Not applicable.
1/ Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
2/ Data are rounded to three significant digits; may not add to totals shown.
3/ Value excluded to avoid disclosing company proprietary data.
4/ Partial total, excludes values that must be concealed to avoid disclosing company proprietary data.

TABLE 2
PENNSYLVANIA: CRUSHED STONE SOLD OR USED, BY KIND 1/

Kind	1996				1997			
	Number of quarries	Quantity (thousand metric tons)	Value (thousands)	Unit value	Number of quarries	Quantity (thousand metric tons)	Value (thousands)	Unit value
Limestone 2/	129 r/	53,900 r/	$313,000 r/	$5.81 r/	123	54,700	$320,000	$5.85
Dolomite	14	10,800	66,900	6.20	16	11,500	71,400	6.22
Sandstone and quartzite	34 r/	6,290 r/	37,200 r/	5.92	35	6,000	35,400	5.90
Traprock	8	2,810	22,400	7.99	9	2,970	22,600	7.62
Granite	7	4,030	25,800	6.40	7	4,210	28,500	6.76
Marble	1	464	2,860	6.17	1	390	2,370	6.07
Miscellaneous stone	19	9,100 r/	49,100 r/	5.40 r/	19	9,390	55,900	5.95
Total	XX	87,400	518,000	5.92	XX	89,200	536,000	6.01

r/ Revised. XX Not applicable.
1/ Data are rounded to three significant digits; may not add to totals shown.
2/ Includes "limestone-dolomite" reported with no distinction between the two.

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TABLE 3
PENNSYLVANIA: CRUSHED STONE SOLD OR USED BY PRODUCERS
IN 1997, BY USE 1/ 2/

Use	Quantity (thousand metric tons)	Value (thousands)	Unit Value
Coarse aggregate (+1 1/2 inch):			
Macadam	222	$1,240	$5.60
Riprap and jetty stone	770	5,560	7.22
Filter stone	425	3,000	7.05
Other coarse aggregate	361	2,580	7.15
Coarse aggregate, graded:			
Concrete aggregate, coarse	3,880	22,200	5.73
Bituminous aggregate, coarse	6,600	37,500	5.68
Bituminous surface-treatment aggregate	1,150	6,690	5.80
Railroad ballast	856	5,010	5.85
Other graded coarse aggregate	2,390	15,200	6.36
Fine aggregate (-3/8 inch):			
Stone sand, concrete	199	1,210	6.08
Stone sand, bituminous mix or seal	2,310	14,200	6.15
Screening, undesignated	1,220	7,350	6.04
Other fine aggregate	643	3,990	6.21
Coarse and fine aggregates:			
Graded road base or subbase	7,930	41,500	5.23
Unpaved road surfacing	1,780	8,410	4.74
Terrazzo and exposed aggregate	109	873	8.01
Crusher run or fill or waste	1,400	5,940	4.23
Other coarse and fine aggregates	5,750	36,600	6.35
Other construction materials	3,100	18,000	5.82
Agricultural:			
Agricultural limestone	332	2,050	6.16
Poultry grit and mineral food	10	119	11.90
Chemical and metallurgical:			
Cement manufacture	6,170	28,900	4.67
Lime manufacture	1,270	7,810	6.18
Flux stone	40	435	10.88
Chemical stone	(3/)	(3/)	6.10
Sulfur oxide removal	266	2,890	10.85
Special:			
Mine dusting or acid water treatment	6	39	6.50
Asphalt fillers or extenders	259	2,240	8.63
Whiting or whiting substitute	401	8,380	20.89
Other fillers or extenders	38	362	9.53
Roofing granules	420	9,260	22.06
Other miscellaneous uses:			
Building products	38	324	8.53
Other specified uses not listed	9	45	5.00
Unspecified: 4/			
Actual	24,500	142,000	5.79
Estimated	14,300	94,200	6.59
Total	89,200	536,000	6.01

1/ Includes dolomite, granite, limestone, limestone-dolomite, marble, miscellaneous stone, sandstone and quartzite, and traprock.
2/ Data are rounded to three significant digits, except unit value; may not add to totals shown.
3/ Less than 1/2 unit.
4/ Includes reported and estimated production without a breakdown by end use.

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TABLE 4
PENNSYLVANIA: CRUSHED STONE SOLD OR USED BY PRODUCERS IN 1997,
BY USE AND DISTRICT 1/

(Thousand metric tons and thousand dollars)

Use	District 1		District 2		District 3	
	Quantity	Value	Quantity	Value	Quantity	Value
Construction aggregates:						
Coarse aggregate (+1 1/2 inch) 2/	W	W	216	1,480	673	4,750
Coarse aggregate, graded 3/	W	W	493	3,120	3,850	24,500
Fine aggregate (-3/8 inch) 4/	W	W	338	2,210	1,020	6,340
Coarse and fine aggregate 5/	W	W	1,450	7,480	4,160	24,400
Other construction materials 6/	292	1,380	6	38	(7/)	(7/)
Agricultural 8/	(7/)	(7/)	(7/)	(7/)	(7/)	(7/)
Chemical and metallurgical 9/	895	5,590	155	1,970	2,950	14,900
Special 10/	1	12	10	159	(8/)	(8/)
Other miscellaneous use 11/	--	--	--	--	--	--
Unspecified: 12/						
Actual	(7/)	(7/)	(7/)	(7/)	639	4,420
Estimated	1,250	8,080	2,010	11,100	3,680	27,200
Total	4,100	23,500	7,940	47,000	19,000	119,000

	District 4		Unspecified districts	
	Quantity	Value	Quantity	Value
Construction aggregates:				
Coarse aggregate (+1 1/2 inch) 2/	877	6,070	--	--
Coarse aggregate, graded 3/	10,500	58,700	(13/)	2
Fine aggregate (-3/8 inch) 4/	2,920	17,900	--	--
Coarse and fine aggregate 5/	11,700	70,100	1	3
Other construction materials 6/	1,070	6,160	2	11
Agricultural 8/	257	1,110	--	--
Chemical and metallurgical 9/	3,740	17,500	--	--
Special 10/	(7/)	(7/)	--	--
Other miscellaneous use 11/	(7/)	(7/)	--	--
Unspecified: 12/				
Actual	19,000	111	--	--
Estimated	7,340	47,800	--	--
Total	58,100	347,000	3	16

W Withheld to avoid disclosing company proprietary data; included with "Other construction materials."
1/ Data are rounded to three significant digits; may not add to totals shown.
2/ Includes filter stone, macadam, riprap and jetty stone, and other coarse aggregate.
3/ Includes concrete aggregate (coarse), bituminous aggregate (coarse), bituminous surface-treatment aggregate, railroad ballast, and other graded coarse aggregate.
4/ Includes stone sand (concrete), stone sand (bituminous mix or seal), screening (undesignated), and other fine aggregate.
5/ Includes graded road base or subbase, terrazzo and exposed aggregate, unpaved road surfacing, crusher run (select material or fill), and other coarse and fine aggregates.
6/ Includes building products and roofing granules.
7/ Withheld to avoid disclosing company proprietary data included in "Total."
8/ Includes agricultural limestone, poultry grit, and mineral food.
9/ Includes cement manufacture, chemical stone, flux stone, lime manufacture, and sulfur oxide removal.
10/ Includes asphalt fillers or extenders, mine dusting or acid water treatment, other fillers or extenders, and whiting or whiting
11/ Includes other specified uses not listed.
12/ Includes reported and estimated production without a breakdown by end use.
13/ Less than ½ unit.

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TABLE 5
PENNSYLVANIA: CONSTRUCTION SAND AND GRAVEL SOLD OR USED IN 1997, BY MAJOR USE CATEGORY 1/

Use	Quantity (thousand metric tons)	Value (thousands)	Value per ton
Concrete aggregate (including concrete sand)	4,120	$29,200	$7.08
Plaster and gunite sands	19	191	10.05
Concrete products (blocks, bricks, pipe, decorative, etc.)	270	1,930	7.15
Asphaltic concrete aggregates and other bituminous mixtures	1,530	8,180	5.34
Road base and coverings	1,360	7,300	5.37
Fill	2,360	6,490	2.75
Snow and ice control	182	1,060	5.85
Roofing granules	5	49	9.80
Other miscellaneous uses	477	3,290	6.90
Unspecified: 2/			
Actual	3,310	18,800	5.69
Estimated	2,090	12,000	5.75
Total or average	15,700	88,500	5.63

1/ Data are rounded to three significant digits, except value per ton; may not add to totals shown.
2/ Includes reported and estimated production without a breakdown by end use.

TABLE 6
PENNSYLVANIA: CONSTRUCTION SAND AND GRAVEL SOLD OR USED IN 1997, BY USE AND DISTRICT 1/

(Thousand metric tons and thousand dollars)

Use	District 1		District 2		District 3		District 4	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
Concrete aggregates	730	4,130	596	3,970	1,820	13,700	978	7,370
Concrete products 2/	W	W	34	331	W	W	W	W
Asphaltic concrete aggregates and other bituminous mixtures	W	W	332	1,490	985	5,480	W	W
Road base and coverings	606	3,240	137	729	551	2,940	65	393
Fill	91	385	144	620	306	1,370	1,820	4,120
Snow and ice control	86	478	26	236	52	235	18	114
Other miscellaneous uses 3/	485	2,700	16	110	325	2,200	125	1,320
Unspecified: 4/								
Actual	736	3,750	1,740	10,700	651	3,450	177	948
Estimated	1,280	6,310	123	638	326	1,960	358	3,100
Total	4,020	21,000	3,150	18,800	5,010	31,300	3,540	17,400

W Withheld to avoid disclosing company proprietary data; included with "Other miscellaneous materials."
1/ Data are rounded to three significant digits; may not add to totals shown.
2/ Includes plaster and gunite sands.
3/ Includes roofing granules.
4/ Includes reported and estimated production without a breakdown by end use.

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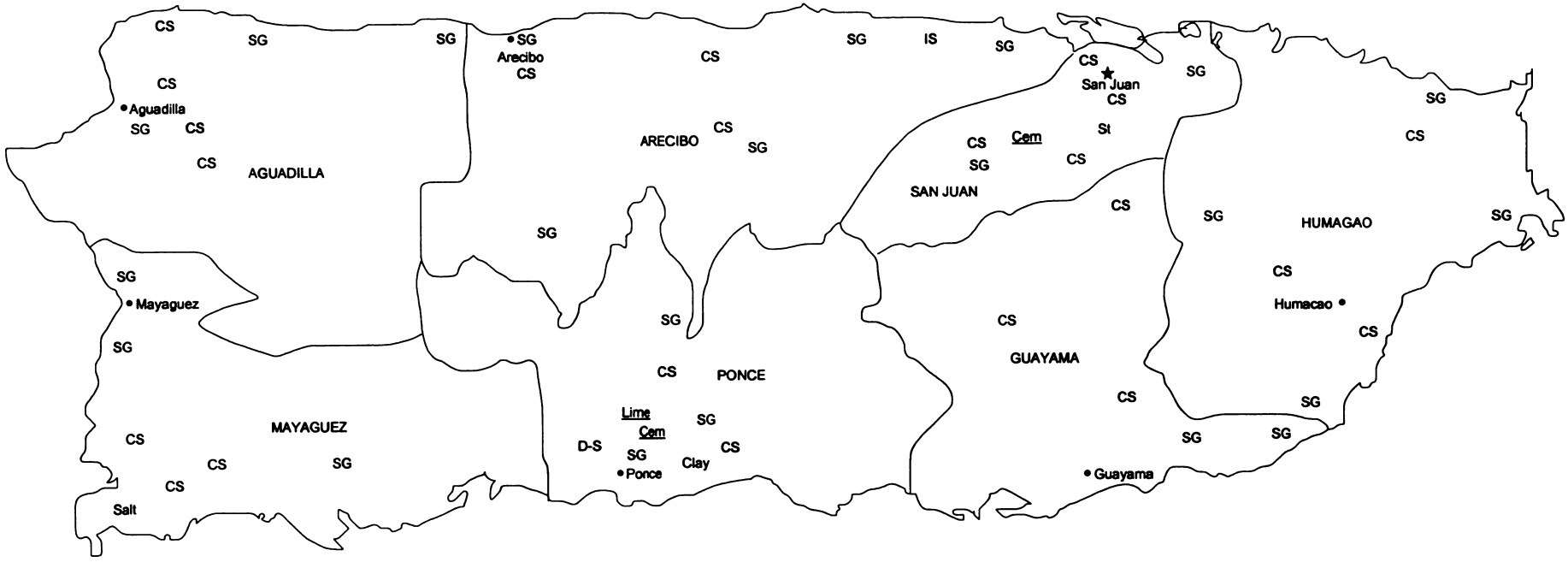
PUERTO RICO



LEGEND **MINERAL SYMBOLS (Major producing areas)**

District boundary	Cem	Cement plant	Lime	Lime plant
Capital	Clay	Clay	Salt	Salt
City	CS	Crushed stone	SG	Sand and gravel
	D-S	Dimension stone	St	Stone
	IS	Industrial sand		

0 100 Kilometers

Source: Department of Natural Resources, Commonwealth of Puerto Rico/U.S. Geological Survey (1998)

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THE MINERAL INDUSTRY OF PUERTO RICO AND THE ADMINISTERED ISLANDS

This chapter has been prepared under a Memorandum of Understanding between the U.S. Geological Survey and the Department of Natural Resources, Bureau of Geology, for collecting information on all nonfuel minerals.

In 1998, the preliminary estimated value[1] of nonfuel mineral production for Puerto Rico[2] was $252 million, according to the U.S. Geological Survey (USGS). If ranked in comparison with the 50 States, Puerto Rico would rank 39th in total nonfuel mineral production value. Portland cement and crushed stone, by value, were the Commonwealth's leading nonfuel mineral commodities. Of the U.S. Administered Islands, Guam is the only one from which nonfuel mineral production has recently been reported to the USGS; reported production has been limited to that from crushed stone companies (table 1).

In 1998, portland cement accounted for the largest share of Puerto Rico's increase in nonfuel mineral value; all other nonfuel minerals increased in value except industrial sand and gravel and salt, which were unchanged. No dimension marble was produced in Puerto Rico in 1997, but production resumed in 1998. The data for dimension stone, as well as for industrial sand and gravel, are withheld to protect company proprietary data. In 1997, crushed stone followed by portland cement accounted for most of the increase in the Commonwealth's nonfuel mineral value.

Construction sand and gravel is produced in Puerto Rico, but production data do not appear in table 1. The collection and compilation of production data for construction sand and gravel mined in the Commonwealth were discontinued in 1973 by the U.S. Bureau of Mines (the Federal Government agency then responsible for the collection of domestic raw nonfuel mineral production data). This data collection ceased because of low rate of response by the industry (Sikich and Alonso, 1993, p. 469).

Metals have not been mined in Puerto Rico since the Juncos iron mine closed in 1953; prospects for resuming metal mining in the near future do not appear to be likely. However, as noted in a publication of the former U.S. Bureau of Mines, metal occurrences are common on the island and the possibility of developing a metal deposit should not be completely discounted (Sikich and Alonso, 1993).

The U.S. Geological Survey will release Open File Report 98-38 on CD-ROM in 2000. The publication is entitled *Geology, Geochemistry, Geophysics, Mineral Occurrences and Mineral Resource Assessment for the Commonwealth of Puerto Rico*. The data were compiled by W.J. Bawiec (U.S. Geological Survey, oral commun., 2000).

[1]The terms "nonfuel mineral production" and related "values" encompass variations in meaning, depending on the minerals or mineral products. Production may be measured by mine shipments, mineral commodity sales, or marketable production (including consumption by producers) as is applicable to the individual mineral commodity.

All 1998 USGS mineral production data published in this chapter are preliminary estimates as of February 1999 and are expected to change. Crushed stone and portland cement estimates are updated periodically. To obtain the most current information, please contact the appropriate USGS mineral commodity specialist. A telephone listing for the specialists may be retrieved over the Internet at http://minerals.usgs.gov/minerals/contacts/comdir.html; by using MINES FaxBack at (703) 648-4999 from a fax machine with a touch-tone handset (request Document #1000 for a telephone listing of all mineral commodity specialists); or by calling USGS information at (703) 648-4000 for the specialist's name and number. All Mineral Industry Surveys—mineral commodity, State, and country—also may be retrieved over the Internet at http://minerals.usgs.gov/minerals; facsimile copies may be obtained from MINES FaxBack.

[2]While a memorandum of understanding (MOU) was officially made between the U.S. Geological Survey (USGS) and the Commonwealth of Puerto Rico, MOU's were not established with the Commonwealth of the Northern Mariana Islands, U.S. Caribbean and Pacific Island Possessions, or the U.S. Trust Territory of the Pacific Islands. Nevertheless, data on nonfuel mineral production were reported to the USGS for the island of Guam of the Pacific Island Possessions. These data appear in table 1.

Reference Cited

Sikich, S.W., and Alonso, R.M., 1993, The mineral industries of Puerto Rico, Northern Marianas, Island Possessions, and Trust Territory, in U.S. Bureau of Mines Minerals Yearbook 1992, v. 2, p. 467- 470.

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TABLE 1
NONFUEL RAW MINERAL PRODUCTION IN THE COMMONWEALTH OF PUERTO RICO
AND ISLANDS ADMINISTERED BY THE UNITED STATES 1/ 2/

(Thousand metric tons and thousand dollars unless otherwise specified)

Mineral		1996		1997		1998 p/	
		Quantity	Value	Quantity	Value	Quantity	Value
Puerto Rico:							
Cement: Portland	metric tons	1,550	W	W	W	1,730	W
Clays: Common		W	W	W	363	W	W
Lime		38	5,050	32	4,580	34	4,600
Salt		45	1,500	45	1,500	45	1,500
Stone: Crushed		13,200	52,500	14,000	71,300	14,500	72,000
Combined value of other industrial minerals		XX	153,000	XX	(3/)	XX	174,000
Total		XX	212,000	XX	77,700 4/	XX	252,000
Administered Islands, Guam: Stone, crushed		1,660	13,800	1,760	10,500	1,800	11,000

p/ Preliminary. W Withheld to avoid disclosing company proprietary data; value included with "Combined value" data.
XX Not applicable.
1/ Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
2/ Data are rounded to three significant digits; may not add to totals shown.
3/ Withheld to avoid disclosing company proprietary data.
4/ Total does not include values of items withheld.

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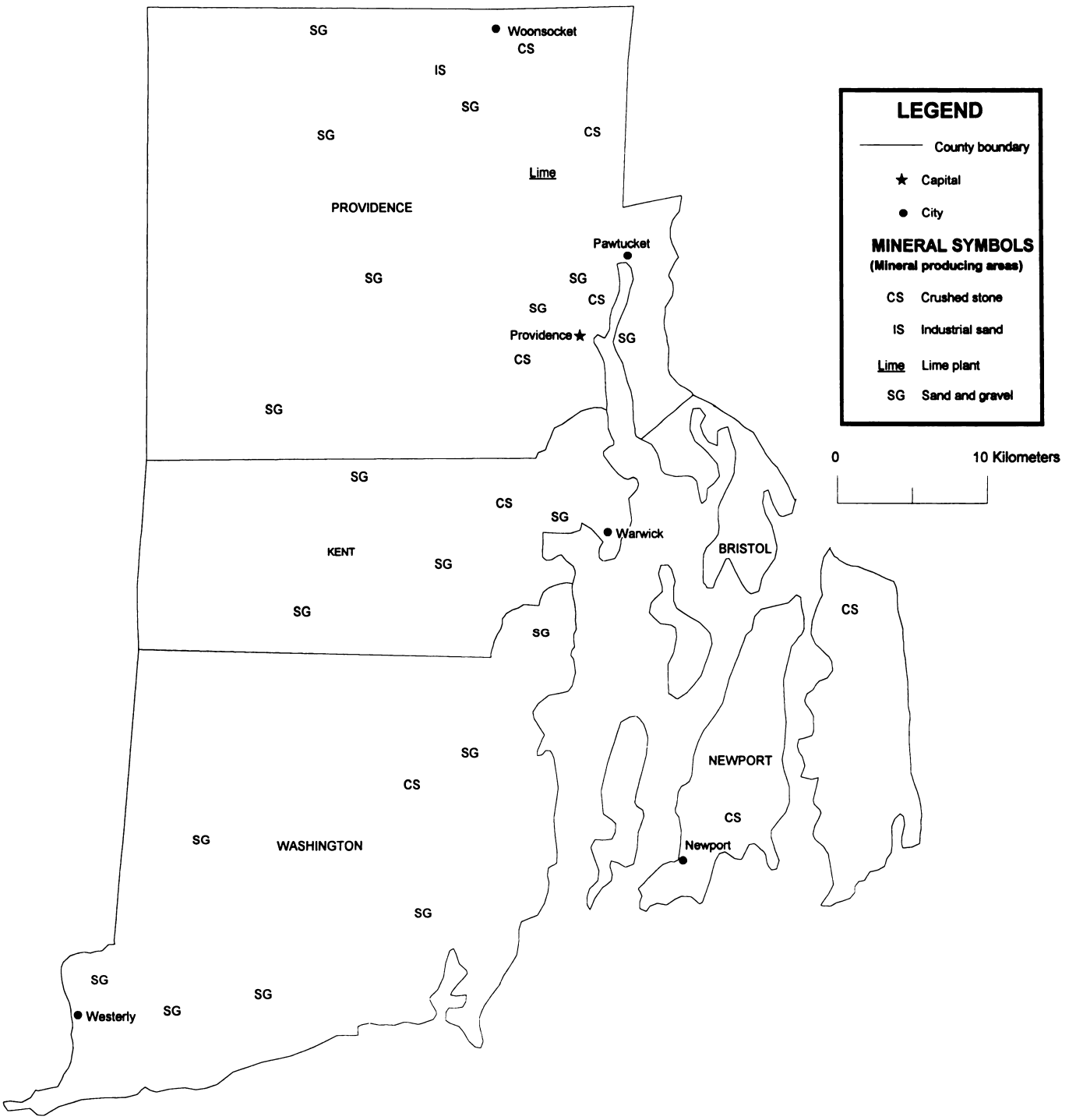
RHODE ISLAND



Source: University of Rhode Island Department of Geology, Office of the State Geologist/U.S. Geological Survey (1998)

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THE MINERAL INDUSTRY OF RHODE ISLAND

This chapter has been prepared under a Memorandum of Understanding between the U.S. Geological Survey and the University of Rhode Island Department of Geology, Office of the State Geologist, for collecting information on all nonfuel minerals.

In 1998, the preliminary estimated value[1] of nonfuel mineral production for Rhode Island was $27.8 million, according to the U.S. Geological Survey. This was about a 2% increase from that of 1997,[2] and followed an 18.3% increase in value from 1996 to 1997. In 1998, the State's increase resulted from an increase in the value of crushed stone (table 1). A similar increase in the value of industrial sand and gravel would have further raised Rhode Island's total nonfuel mineral value, but that data were withheld to avoid disclosing company proprietary information. While the value of construction sand and gravel, Rhode Island's leading nonfuel mineral commodity, decreased slightly for the year, gemstones again remained unchanged. In 1997, all nonfuel minerals increased in value except gemstones.

[1]The terms "nonfuel mineral production" and related "values" encompass variations in meaning, depending on the minerals or mineral products. Production may be measured by mine shipments, mineral commodity sales, or marketable production (including consumption by producers) as is applicable to the individual mineral commodity.

All 1998 USGS mineral production data published in this chapter are preliminary estimates as of February 1999 and are expected to change. Construction sand and gravel and crushed stone estimates are updated periodically. To obtain the most current information, please contact the appropriate USGS mineral commodity specialist. A telephone listing for the specialists may be retrieved over the Internet at http://minerals.usgs.gov/minerals/contacts/comdir.html; by using MINES FaxBack at (703) 648-4999 from a fax machine with a touch-tone handset (request Document #1000 for a telephone listing of all mineral commodity specialists); or by calling USGS information at (703) 648-4000 for the specialist's name and number. All Mineral Industry Surveys—mineral commodity, State, and country—also may be retrieved over the Internet at http://minerals.usgs.gov/minerals; facsimile copies may be obtained from MINES FaxBack.

[2]Values, percentage calculations, and rankings for 1997 may vary from the *Minerals Yearbook, Area Reports: Domestic 1997, Volume II*, owing to the revision of preliminary 1997 to final 1997 data. Data for 1998 are preliminary and expected to change, while related rankings may also be subject to change.

TABLE 1
NONFUEL RAW MINERAL PRODUCTION IN RHODE ISLAND 1/ 2/

(Thousand metric tons and thousand dollars unless otherwise specified)

Mineral	1996		1997		1998 p/	
	Quantity	Value	Quantity	Value	Quantity	Value
Gemstones	NA	1	NA	1	NA	1
Sand and gravel: Construction	1,990	13,300	1,960	15,700	2,070	17,000
Stone: Crushed	1,440	9,680	1,830	11,500	1,800	10,800
Total 3/	XX	23,000	XX	27,200	XX	27,800

p/ Preliminary. NA Not available. XX Not applicable.
1/ Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
2/ Data are rounded to three significant digits; may not add to totals shown.
3/ Partial total, excludes values which must be concealed to avoid disclosing company proprietary data.

TABLE 2
RHODE ISLAND: CRUSHED STONE SOLD OR USED, BY KIND 1/

Kind	1996				1997			
	Number of quarries	Quantity (thousand metric tons)	Value (thousands)	Unit value	Number of quarries	Quantity (thousand metric tons)	Value (thousands)	Unit value
Limestone	1	W	W	W	1	W	W	W
Granite	5	948	$6,680	$7.05	5	1,300	$8,210	$6.31
Traprock	2	W	W	W	2	W	W	W
Total	XX	1,440	9,680	6.74	XX	1,830	11,500	6.30

W Withheld to avoid disclosing company proprietary data; included in "Total." XX Not applicable.
1/ Data are rounded to three significant digits; may not add to totals shown.

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TABLE 3
RHODE ISLAND: CRUSHED STONE SOLD OR USED BY PRODUCERS
IN 1997, BY USE 1/ 2/ 3/

Use	Quantity (thousand metric tons)	Value (thousands)	Unit value
Coarse aggregate (+1 1/2 inch):			
Filter stone	7	$38	$5.43
Other coarse aggregate 4/	3	11	3.67
Coarse aggregate, graded:			
Bituminous surface-treatment aggregate	78	430	5.51
Other graded coarse aggregate 5/	79	666	8.43
Fine aggregate (-3/8 inch): Other fine aggregate 6/	119	735	6.18
Coarse and fine aggregates:			
Unpaved road surfacing	38	212	5.58
Crusher run or fill or waste	17	158	9.29
Other coarse and fine aggregates 7/	56	359	6.41
Agricultural limestone	W	W	12.17
Other miscellaneous uses: Other specified uses not listed	W	W	12.17
Unspecified: 8/			
Actual	W	W	6.20
Estimated	677	4,200	6.20
Total	1,830	11,500	6.30

W Withheld to avoid disclosing company proprietary data; included in "Total."
1/ To avoid disclosing company proprietary data, district tables were not produced for 1997.
2/ Includes granite, limestone, and traprock.
3/ Data are rounded to three significant digits, except unit value; may not add to totals shown.
4/ Includes riprap and jetty stone.
5/ Includes bituminous aggregate (coarse) and concrete aggregate (coarse).
6/ Includes stone sand (concrete), stone sand (bituminous mix or seal), and screening (undesignated).
7/ Includes graded road base or subbase.
8/ Includes reported and estimated production without a breakdown by end use.

TABLE 4
RHODE ISLAND: CONSTRUCTION SAND AND GRAVEL SOLD OR USED IN 1997,
BY MAJOR USE CATEGORY 1/ 2/

Use	Quantity (thousand metric tons)	Value (thousands)	Value per ton
Concrete aggregate and concrete products 3/	740	$6,580	$8.89
Asphaltic concrete aggregates and other bituminous mixtures	411	3,730	9.09
Road base and coverings	117	807	6.90
Fill	156	905	5.80
Snow and ice control	17	146	8.59
Railroad ballast	W	W	W
Unspecified:			
Actual	W	W	W
Estimated	446	2,650	5.95
Total or average	1,960	15,700	7.99

W Withheld to avoid disclosing company proprietary data; included in "Total."
1/ To avoid disclosing company proprietary data, no district tables were produced in 1997.
2/ Data are rounded to three significant digits, except value per ton; may not add to totals shown.
3/ Includes plaster and gunite sands.

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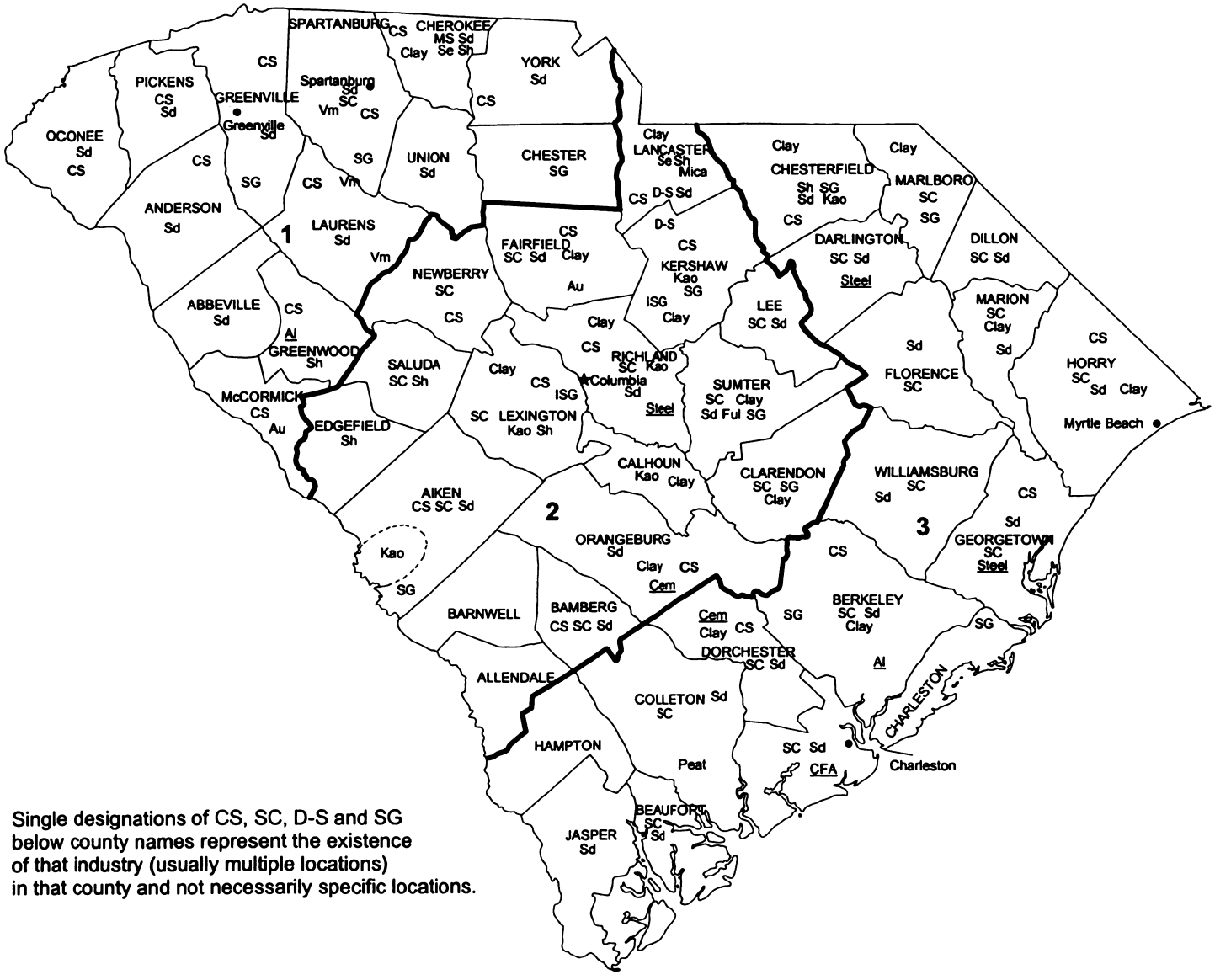
SOUTH CAROLINA



Single designations of CS, SC, D-S and SG below county names represent the existence of that industry (usually multiple locations) in that county and not necessarily specific locations.

LEGEND

- County boundary
- ★ Capital
- ● City
- 1 ▬ Crushed stone/sand and gravel districts

MINERAL SYMBOLS
(Major producing areas)

Al	Aluminum plant
Au	Gold
Cem	Cement plant
CFA	Chrome ferroalloy plant
Clay	Clay
CS	Crushed stone
D-S	Dimension stone
Ful	Fuller's earth
ISG	Industrial sand and gravel
Ka	Kaolin
Mica	Mica
MS	Manganese schist
Peat	Peat
SC	Sand and clay
Sd	Sand
Se	Sericite
SG	Sand and gravel
Sh	Shale
Steel	Iron and steel plant
Vm	Vermiculite
⬭	Concentration of mineral operations

0 — 40 Kilometers

Source: South Carolina Geological Survey/U.S. Geological Survey (1998)

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THE MINERAL INDUSTRY OF SOUTH CAROLINA

This chapter has been prepared under a Memorandum of Understanding between the U.S. Geological Survey and the South Carolina Geological Survey for collecting information on all nonfuel minerals.

In 1998, the preliminary estimated value[1] of nonfuel mineral production for South Carolina was $589 million, according to the U.S. Geological Survey (USGS). This was about a 4% increase from that of 1997,[2] and followed a 15% increase in 1997 from that of 1996. The State ranked 25th in the Nation in 1998 (23d in 1997) in total nonfuel mineral production value, of which South Carolina accounted for nearly 1.5% of the U.S. total.

Most of the State's nonfuel mineral commodities increased in value in 1998, led by a nearly 7% rise ($14 million) in crushed stone and an almost 6% ($11 million) increase in portland cement (table 1). Kaolin, crude mica, and silver decreased slightly, and gemstones and manganiferous ore were unchanged. Only gold, dropping by about 21%, showed any significant decrease. In 1997, most of the State's increase in value was accounted for by a $56 million rise in the value of crushed stone, a combined increase of more than $16 million in portland and masonry cements, and an $11 million rise in kaolin (table 1).

Based on USGS estimates of the quantities produced in the 50 States in 1998, South Carolina remained the only[2] State to produce manganiferous ore, second in kaolin, fourth in masonry cement, fourth of 5 crude mica-producing States, and sixth in common clays. While the State continued as 10th of the 13 gold-producing States, it dropped from 1st to 2d of the 2 States that produce vermiculite. Additionally, significant quantities of crushed stone, portland cement, and industrial sand and gravel, in descending order of value, were produced in South Carolina. Primary aluminum and raw steel also were produced in the State, but from raw materials that were acquired from other domestic and foreign sources. South Carolina remained seventh of 14 States in the production of primary aluminum in 1998.

[1]The terms "nonfuel mineral production" and related "values" encompass variations in meaning, depending on the minerals or mineral products. Production may be measured by mine shipments, mineral commodity sales, or marketable production (including consumption by producers) as is applicable to the individual mineral commodity.

All 1998 USGS mineral production data published in this chapter are preliminary estimates as of February 1999 and are expected to change. For some mineral commodities (for example, construction sand and gravel, crushed stone, and portland cement), estimates are updated periodically. To obtain the most current information, please contact the appropriate USGS mineral commodity specialist. A telephone listing for the specialists may be retrieved over the Internet at http://minerals.usgs.gov/minerals/contacts/comdir.html; by using MINES FaxBack at (703) 648-4999 from a fax machine with a touch-tone handset (request Document #1000 for a telephone listing of all mineral commodity specialists); or by calling USGS information at (703) 648-4000 for the specialist's name and number. All Mineral Industry Surveys—mineral commodity, State, and country—also may be retrieved over the Internet at http://minerals.usgs.gov/minerals; facsimile copies may be obtained from MINES FaxBack.

[2]Values, percentage calculations, and rankings for 1997 may vary from the *Minerals Yearbook, Area Reports: Domestic 1997, Volume II*, owing to the revision of preliminary 1997 to final 1997 data. Data for 1998 are preliminary and expected to change, while related rankings may also be subject to change.

TABLE 1
NONFUEL RAW MINERAL PRODUCTION IN SOUTH CAROLINA 1/ 2/

(Thousand metric tons and thousand dollars unless otherwise specified)

Mineral	1996		1997		1998 p/	
	Quantity	Value	Quantity	Value	Quantity	Value
Cement:						
Masonry	286	27,100 e/	334	35,500 e/	340	37,300
Portland	2,370	186,000 e/	2,520	194,000 e/	2,610	205,000
Clays:						
Common	1,260	4,860	1,080	2,850	1,100	2,910
Fire	24	W	--	--	--	--
Kaolin	387	18,100	447	29,000	468	28,400
Gemstones	NA	16	NA	1	NA	1
Sand and gravel:						
Construction	8,780	29,000	8,130	30,400	8,770	33,800
Industrial	761	19,500	770	19,300	775	19,400
Stone: Crushed	23,800	146,000	25,900	202,000	27,400	216,000
Combined values of gold, manganiferous ore (1997-98), mica (crude), silver, stone (dimension granite), vermiculite, and value indicated by symbol W	XX	62,700	XX	54,200	XX	45,600
Total	XX	493,000	XX	567,000	XX	589,000

e/ Estimated. p/ Preliminary. NA Not available. W Withheld to avoid disclosing company proprietary data; value included with "Combined values data. XX Not applicable.
1/ Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
2/ Data are rounded to three significant digits; may not add to totals shown.

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TABLE 2
SOUTH CAROLINA: CRUSHED STONE SOLD OR USED, BY KIND 1/

Kind	1996 Number of quarries	1996 Quantity (thousand metric tons)	1996 Value (thousands)	1996 Unit value	1997 Number of quarries	1997 Quantity (thousand metric tons)	1997 Value (thousands)	1997 Unit value
Limestone	8 r/	4,460 r/	$22,800 r/	$5.11 r/	10	4,490	$34,800	$7.74
Calcareous marl	2	W	W	W	2	W	W	W
Granite	23 r/	17,000 r/	114,000 r/	6.72 r/	25	19,000	157,000	8.27
Marble	1	W	W	W	1	W	W	W
Total	XX	23,800	146,000	6.15	XX	25,900	202,000	7.79

r/ Revised. W Withheld to avoid disclosing company proprietary data; included in "Total." XX Not applicable.
1/ Data are rounded to three significant digits; may not add to totals shown.

TABLE 3
SOUTH CAROLINA: CRUSHED STONE SOLD OR USED BY PRODUCERS IN 1997, BY USE 1/ 2/

Use	Quantity (thousand metric tons)	Value (thousands)	Unit value
Coarse aggregate (+1 1/2 inch):			
Riprap and jetty stone	146	$1,910	$13.09
Filter stone	W	W	W
Coarse aggregate, graded 3/	2,160	17,600	8.15
Fine aggregate (-3/8 inch) 4/	884	6,560	7.42
Coarse and fine aggregates			
Crusher run or fill or waste	3,830	23,400	6.11
Other coarse and fine aggregates 5/	1,950	16,500	8.47
Chemical and metallurgical: Cement manufacture	W	W	W
Unspecified: 6/			
Actual	14,700	128,000	8.67
Estimated	349	1,930	5.52
Total	25,900	202,000	7.79

W Withheld to avoid disclosing company proprietary data; included in "Total."
1/ Includes calcareous marl, granite, limestone, and marble.
2/ Data are rounded to three significant digits, except unit value; may not add to totals shown.
3/ Includes bituminous aggregate (coarse), bituminous surface treatment aggregate, concrete aggregate (coarse), other graded coarse aggregate, and railroad ballast.
4/ Includes screening (undesignated), stone sand (bituminous mix or seal), and stone sand (concrete).
5/ Includes graded road base or subbase.
6/ Includes reported and estimated production without a breakdown by end use.

TABLE 4
SOUTH CAROLINA: CRUSHED STONE SOLD OR USED BY PRODUCERS IN 1997, BY USE AND DISTRICT 1/

(Thousand metric tons and thousand dollars)

Use	District 1 Quantity	District 1 Value	District 2 Quantity	District 2 Value	District 3 Quantity	District 3 Value
Construction aggregates:						
Coarse aggregate (+1 1/2 inch) 2/	229	2,590	--	--	W	W
Coarse aggregate, graded 3/	W	W	--	--	W	W
Fine aggregate (-3/8 inch) 4/	W	W	--	--	W	W
Coarse and fine aggregate 5/	W	W	--	--	W	W
Other construction materials	8,040	53,600	--	--	801	10,700
Chemical and metallurgical 6/	--	--	--	--	(7/)	(7/)
Unspecified: 8/						
Actual	2,440	19,700	7,520	61,600	(7/)	(7/)
Estimated	98	474	160	1,010	90	440
Total	10,800	76,400	7,680	62,600	7,420	62,800

W Withheld to avoid disclosing company proprietary data; included with "Other construction materials."
1/ Data are rounded to three significant digits; may not add to totals shown.
2/ Includes filter stone and riprap and jetty stone.
3/ Includes bituminous aggregate (coarse), bituminous surface-treatment aggregate, concrete aggregate (coarse), and railroad ballast.
4/ Includes screening (undesignated), stone sand (bituminous mix or seal), and stone sand (concrete).
5/ Includes crusher run (select material or fill), graded road base or subbase, and other coarse and fine aggregates.
6/ Includes cement manufacture.
7/ Withheld to avoid disclosing company proprietary data; included in "Total."
8/ Includes reported and estimated production without a breakdown by end use.

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TABLE 5
SOUTH CAROLINA: CONSTRUCTION SAND AND GRAVEL SOLD OR USED IN 1997,
BY MAJOR USE CATEGORY 1/

Use	Quantity (thousand metric tons)	Value (thousands)	Value per ton
Concrete aggregate (including concrete sand)	3,430	$12,300	$3.59
Concrete products (blocks, bricks, pipe, decorative, etc.)	232	708	3.05
Asphaltic concrete aggregates and road base materials 2/	149	624	4.19
Fill	735	1,810	2.46
Snow and ice control	138	505	3.66
Other miscellaneous uses	6	12	2.00
Unspecified: 3/			
Actual	2,130	9,770	4.58
Estimated	1,300	4,670	3.58
Total or average	8,130	30,400	3.74

1/ Data are rounded to three significant digits; may not add to totals shown.
2/ Includes road and other stabilization (cement).
3/ Includes reported and estimated production without a breakdown by end use.

TABLE 6
SOUTH CAROLINA: CONSTRUCTION SAND AND GRAVEL SOLD OR USED IN 1997,
BY USE AND DISTRICT 1/

(Thousand metric tons and thousand dollars)

Use	District 1		District 2		District 3	
	Quantity	Value	Quantity	Value	Quantity	Value
Concrete aggregate and concrete products 2/	242	1,190	1,370	4,530	2,050	7,310
Asphaltic concrete and road base materials 3/	W	W	W	W	60	239
Other miscellaneous uses 4/	244	1,010	236	395	488	1,310
Unspecified 5/	4	57	1,280	5,360	2,160	9,030
Total	490	2,250	2,890	10,300	4,750	17,900

W Withheld to avoid disclosing company proprietary data; included with "Other miscellaneous uses."
1/ Data are rounded to three significant digits; may not add to totals shown.
2/ Includes plaster and gunite sands.
3/ Includes road and other stabilization (cement).
4/ Includes fill and snow and ice control.
5/ Includes reported and estimated production without a breakdown by end use.

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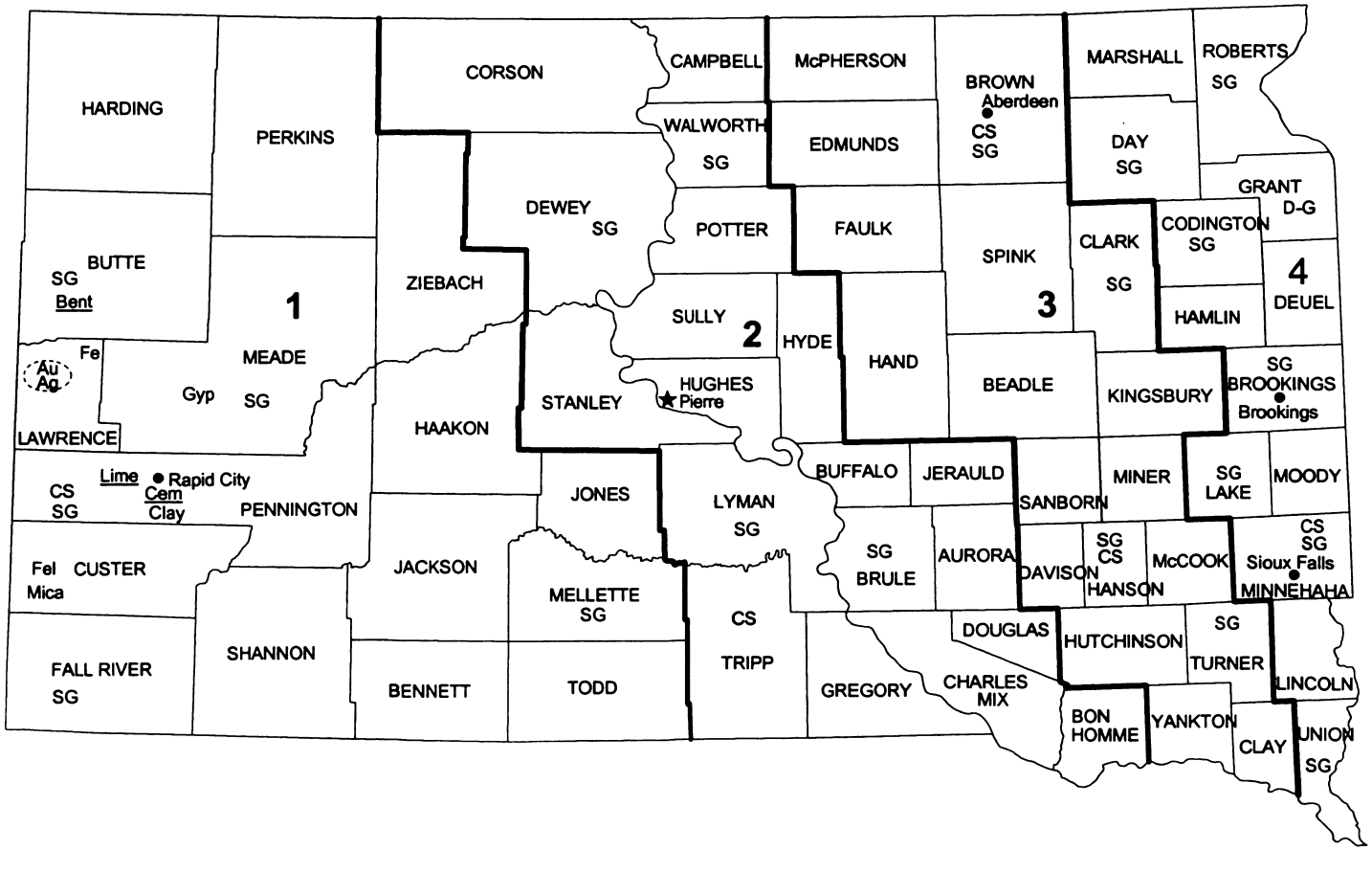
SOUTH DAKOTA



LEGEND

- County boundary
- ★ Capital
- ● City
- 1 Crushed stone/sand and gravel districts

MINERAL SYMBOLS
(Major producing areas)

Ag	Silver
Au	Gold
Bent	Bentonite mill
Cem	Cement plant
Clay	Clay
CS	Crushed stone
D-G	Dimension granite
Fe	Iron
Fel	Feldspar
Gyp	Gypsum
Lime	Lime plant
Mica	Mica
SG	Sand and gravel
⬭	Concentration of mineral operations

0 50 Kilometers

Source: South Dakota Geological Survey/U.S. Geological Survey (1998)

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THE MINERAL INDUSTRY OF SOUTH DAKOTA

This chapter has been prepared under a Memorandum of Understanding between the U.S. Geological Survey and the South Dakota Geological Survey for collecting information on all nonfuel minerals.

In 1998, the preliminary estimated value[1] of nonfuel mineral production for South Dakota was $269 million, according to the U.S. Geological Survey (USGS). This was about an 18% decrease from that of 1997,[2] and followed a 6.6% decrease from 1996 to 1997.

Gold remained South Dakota's leading nonfuel mineral by value, accounting for about 45% of the State's total nonfuel mineral production value. In 1998, declines in the values of gold and granite dimension stone accounted for most of State's decrease in value (table 1). Small decreases also occurred for crude gypsum, usable iron ore, and silver. Most other nonfuel minerals increased, led by a more than $3 million increase in the combined values of portland and masonry cements. In 1997, relatively small to moderate gains in the values of construction sand and gravel, crushed stone, and portland cement were significantly less than the decreases in other commodities (mostly in gold), resulting in a net drop in value.

Based on USGS estimates of the quantities produced in the 50 States during 1998, South Dakota rose to fourth from fifth[2] in gold and remained fifth in mica and seventh in feldspar. Additionally, South Dakota was a leading State in the production of granite dimension stone.

The following narrative information was provided by the South Dakota Geological Survey (SDGS)[3] of the State's Department of Environment and Natural Resources (DENR) (T.V. Durkin, E.H. Holm, and D.K. Burtts, DENR, accessed November 19, 1999, at URL http://www.state.sd.us/denr/DES/Mining/1998sum.htm).[4] There was a major decline in South Dakota gold production in 1998. The gold mines in the northern Black Hills produced more than 12,100 kilograms (about 390,000 troy ounces) of gold in 1998. This represented a 26% drop in the amount of gold produced the previous year, but because of lower gold prices this equated to a 34% drop in gross value. The average price of gold in 1998 was slightly above $294 per troy ounce, yielding a gross value of about $115 million for the State's gold mining industry. The State's mines were surface heap-leach operations with the exception of Homestake Mining Co., which had underground and opencut surface operations.

In early 1998, Homestake announced that it was temporarily shutting down the underground portion of its Homestake Mine to institute a new mining plan to help the company withstand low gold prices without permanently shutting down the mine. When operations resumed in April, the workforce was reduced from 850 to 380 employees and gold production decreased from about 12,400 kilograms (kg) in 1997 (8,100 kg from the underground operation and 4,300 kg from the opencut surface operation) to about 8,600 in 1998 (3,600 kg underground and 5,000 kg open cut). In September, Homestake completed mining in the Open Cut.

Other large-scale gold operations in South Dakota that produced gold in 1998 included the Wharf Mine, operated by Wharf Resources Ltd. and the Gilt Edge Mine, operated by Brohm Mining Corp. Wharf Resources production slightly increased to 3,250 kg in 1998 from 3,210 kg in 1997, and Brohm Mining's production went from 838 kg in 1997 to about 70 kg in 1998, owing to the closure of Gilt Edge and delays in commencing the mining of its Anchor Hill deposit. The Golden Reward Mine, owned by Goldcorp, Inc. and Dakota Mining Co., remained under temporary cessation and produced no gold. LAC Minerals (USA) Inc.'s Richmond Hill Mine is no longer producing gold and the mine was undergoing final reclamation.

In June 1998, the South Dakota Board of Minerals and Environment conditionally approved a permit application from Wharf Resources for its expansion project north and east of the present Wharf Mine, which has operated in South Dakota since 1982. During the next 10 years, Wharf will mine two new pits in phases, reclaiming one pit while mining another. The project involves about 250 hectares, of which more than 110 hectares will be affected by the operation and 136 hectares will be undisturbed. The company estimated that total production would be more than 19 million metric tons of ore with an average grade of 1.1 grams gold per ton, containing about 21,100 kg of gold. Ore from the expansion project will be processed at the existing facilities at the Wharf Mine. About 50 million tons of overburden and waste rock

[1]The terms "nonfuel mineral production" and related "values" encompass variations in meaning, depending on the minerals or mineral products. Production may be measured by mine shipments, mineral commodity sales, or marketable production (including consumption by producers) as is applicable to the individual mineral commodity.

All 1998 USGS mineral production data published in this chapter are preliminary estimates as of February 1999 and are expected to change. For some mineral commodities (for example, construction sand and gravel, crushed stone, and portland cement), estimates are updated periodically. To obtain the most current information, please contact the appropriate USGS mineral commodity specialist. A telephone listing for the specialists may be retrieved over the Internet at http://minerals.usgs.gov/minerals/contacts/comdir.html; by using MINES FaxBack at (703) 648-4999 from a fax machine with a touch-tone handset (request Document #1000 for a telephone listing of all mineral commodity specialists); or by calling USGS information at (703) 648-4000 for the specialist's name and number. All Mineral Industry Surveys—mineral commodity, State, and country—also may be retrieved over the Internet at http://minerals.usgs.gov/minerals; facsimile copies may be obtained from MINES FaxBack.

[2]Values, percentage calculations, and rankings for 1997 may vary from the *Minerals Yearbook, Area Reports: Domestic 1997, Volume II*, owing to the revision of preliminary 1997 to final 1997 data. Data for 1998 are preliminary and expected to change, while related rankings may also be subject to change.

[3]T.V. Durkin, E.H. Holm, and D.K. Burtts of the Minerals and Mining Program (MMP), South Dakota Department of Environment and Natural Resources, jointly authored the text of mineral industry information used in the remainder of this publication.

[4]Production data in the following text are those reported by the SDGS, based on its own surveys and estimates. They may differ from some production figures reported to the USGS.

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will be displaced/generated during the life of the project. The majority of the waste rock will be used as backfill, while some waste rock will be placed in a new waste depository that will partially cover a relic tailings area.

Nonmetallic Industrial Minerals

During the 1998 reporting period, 503 companies had active mine licenses in South Dakota. An operator must obtain a license to mine for sand, gravel, pegmatite minerals, rock used in the process of making cement or lime used in construction. There were also a total of 52 mine permits that covered the mining of other non-metallic minerals such as slate, bentonite, and dimension stone.

Sand and gravel was the major industrial mineral commodity; more than 13.7 million tons of production were reported. Sand and gravel is produced in nearly every county in South Dakota and is used mainly for road construction projects.

Sioux quartzite was the next largest industrial mineral commodity with about 2.55 million tons produced. It is quarried from four locations in southeastern South Dakota. Most of the quartzite is crushed and used in construction, whereas some of the larger blocks are used for rip-rap, railroad ballast, and occasionally for decorative purposes.

Pegmatite mining, mainly in the southern Black Hills, produced more than 15,500 tons of pegmatite minerals such as feldspar, mica, and rose quartz.

The South Dakota Cement Plant of Rapid City, Pennington County, reported mining almost 1.2 million tons of limestone, 188,000 tons of shale, 41,000 tons of gypsum, and 30,500 tons of sand.

More than 240,000 tons of granite was mined by Dakota Granite Co. and Cold Spring Granite Co. from quarries near Milbank, in Grant County in northeastern South Dakota. Due to its beauty and distinctive red color, the mahogany granite (much of it goes to international markets) is used primarily for floor tiles, monuments, and building construction. Waste granite was crushed and used in road construction. Total sales from 1998 production were $40.4 million.

More than 36,000 tons of bentonite was mined in the western portion of the State.

Exploration

Five exploration permits were issued in 1998 to Luff Exploration Co., Homestake Mining Co., and three other individual and joint operators. Of 640 test holes that were permitted for drilling in Harding and Lawrence Counties, 600 were seismic shot holes drilled by Luff Exploration for oil and gas exploration in Harding County and 40 were permitted by Homestake Mining for all minerals excluding uranium in Lawrence County. Also in Lawrence County, 65 prospect pits and a bulk sample were permitted to two individual operators in a joint operation to conduct exploration for cassiterite, tantalite, scheelite, and placer gold. An exploration permit for amphibolite, gold, and quartz schist in Custer County was issued to two individuals involving the removal of waste rock previously stockpiled on a site and the removal of up to 4,500 tons of material from an underground drift as a bulk sample.

Mine Reclamation

The pit impoundment at LAC Minerals' Richmond Hill Mine, designed to reclaim impacts from acid mine drainage (AMD) that occurred at the site in 1992, continued to perform well based on results of about 3years of performance monitoring of the facility. In 1995, the reclaimed pit impoundment was fitted with numerous performance monitoring devices designed to track the long-term success of remedial measures. Results from gravity and barrel lysimeters, heat dissipation units, neutron probes, piezometers, pore gas (oxygen and CO_2) monitoring, temperature probes, water quality and aquatic monitoring, and cap settlement surveys, have indicated that the reclaimed site continues to perform well. Performance monitoring data continued to be collected at the site. Water quality data from some wells and surface sites continued to show impacts from AMD, reinforcing the need to monitor the results and trends at these and other monitoring stations in future sampling events (currently scheduled to occur indefinitely.) Performance monitoring data are on file at the DENR and are available to the public.

Although the DENR does not have an abandoned mine reclamation program, the agency worked with the U.S. Forest Service (USFS), the U.S. Bureau of Land Management (BLM), and the U.S. Environmental Protection Agency to begin the process of reclaiming two abandoned mine sites in the northern Black Hills. Funds from the Federal Government's Comprehensive Environmental Response, Compensation, and Liability Act (Superfund) are being used to reclaim both mine sites: the Minnesota Ridge Mine located on USFS and private property and the Belle Eldridge Mine located on BLM land. Both of these mines are typified by draining mine tunnels, AMD consisting of elevated heavy metals and other contaminants, sulfide waste rock piles, eroding streamside tailings, dilapidated structures, and open shafts. According to DENR's inventory of known inactive and abandoned mines in South Dakota's Black Hills has identified approximately 900 historic mine sites; about 200 are located on Federal land (mostly USFS) and about 700 are on private land. More information on inactive and abandoned mines in the Black Hills can be found on the Internet at URL http://www.state.sd.us/denr/ DES/Mining/acidmine.htm.

Environmental Issues

Enforcement.—The DENR issued a notice of violation (NOV) to Homestake Mining Co. in 1998. Homestake was issued one NOV and an order to correct the situation that led to a tailings release into Gold Run Creek. This NOV also covered a release in November 1997 when a slurry line to the underground mine plugged and allowed the slurry to back up and escape through a vent line onto adjacent soils and into Whitewood Creek. In the November 1997 release, it was estimated that less than 400 liters (L) of slurry entered the creek. Cyanide and heavy metals in the slurry killed about 65 brown trout. In May 1998, an estimated 40,000 L of tailings from Homestake's west sand plant, containing heavy metals and about 4.5 kg of cyanide, escaped containment and flowed into Gold Run Creek and Whitewood Creek. The discharge contributed to a fish kill downstream in the Deadwood area.

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Homestake took immediate steps to mitigate the effects of the discharge. The company performed an immediate biological assessment on Whitewood Creek to assess the impact of the spill while simultaneously removing about 11 to 14 tons of tailings from Gold Run Creek. In a settlement agreement signed in December 1998, Homestake agreed to pay $200,000 (a penalty of $150,000 paid to the DENR's emergency response fund and $50,000 paid to the city of Lead to separate stormwater flows from the Lead sewer system). As part of the settlement agreement, Homestake also agreed to conduct a thorough assessment to identify and correct any structural problems with its mill to ensure that future releases not occur. Homestake must also conduct biological studies of Whitewood Creek over the next 3 years to ensure these two releases did not have any long-term negative impact on Whitewood Creek.

Brohm Mining's Gilt Edge and Anchor Hill Projects.—Dakota Mining Corp., owner of Brohm Mining's Gilt Edge and Anchor Hill Mines, continued to experience financial and environmental difficulties throughout 1998. Acid mine drainage at the Gilt Edge Mine (operations curtailed in September 1997) continued to be a significant problem. In early January 1998, several environmental and citizens groups appealed the USFS November 1997 decision to allow Brohm to proceed with the Phase II expansion of the Anchor Hill project. In February 1998 the USFS withdrew approval citing deficiencies in the Environmental Impact Statement (EIS). Addressing the deficiencies and submitting a supplement to the EIS delayed the project. Unable to finance continuing operations at the site, Dakota Mining announced in May that it would abandon the mine site. The State Governor went to the State's eighth circuit court and obtained a temporary restraining order and a Preliminary Injunction preventing Dakota/Brohm from abandoning the mine. As of June 1999, the company has complied with the restraining order and injunction. In July, the USFS issued a new Record of Decision (ROD) approving the expansion of the Anchor Hill Mine. In September, an organization called Earthlaw filed an appeal of the ROD on behalf of several parties, but in October, the Forest Service denied the Earthlaw appeal. At year end, Dakota was pursuing financing for the Anchor Hill Project and finalizing plans for the mine's operation and reclamation.

In the process of shutting down the Gilt Edge Mine, no reclamation work was completed. The water treatment plant continued to periodically treat acidic water collected at the mine and Brohm periodically continued to evaporate acidic water held in two pits at the Gilt Edge. The treatment and evaporation system could not keep up with inflows from precipitation. The amount of AMD water stored in the pits decreased to about 260 L at the end of 1997, and then increased to about 360 L at the end of 1998. The water treatment plant, which uses sodium hydroxide as a reagent, was effective at removing much of the metals and raising the pH in the AMD water prior to discharge, but the concentrations of parameters such as sulfate, total dissolved solids, sodium, and conductivity remained very high in the discharge.

Nitrate Treatment.—Bacteria have been used for nitrate-reduction in mine waters prior to discharge at two denitrification plants at the Wharf Mine and in a pond system at the Golden Reward Mine. The biotechnology has been successful at reducing nitrate concentrations. Various levels of nitrate reduction can be achieved, depending on site specifics. Some additional concerns that were raised in 1998 over potential impacts to human health and the environment from microorganisms involved in the process were being investigated by the companies and the DENR.

TABLE 1
NONFUEL RAW MINERAL PRODUCTION IN SOUTH DAKOTA 1/ 2/

(Thousand metric tons and thousand dollars unless otherwise specified)

Mineral		1996 Quantity	1996 Value	1997 r/ Quantity	1997 r/ Value	1998 p/ Quantity	1998 p/ Value
Clay: Common		147	W	182	W	185	W
Gemstones		NA	98	NA	98	NA	98
Gold 3/	kilograms	W	W	W	W	12,700	121,000
Gypsum, crude		W	W	51	469	56	399
Sand and gravel: Construction		8,750	27,700	10,200	34,100	9,840	34,100
Silver 3/	metric tons	5	849 r/	4	694	4	656
Stone: Crushed		5,640	28,700	5,900	30,200	6,000	30,600
Combined values of cement, feldspar, iron ore (usable), lime, mica (crude), stone (dimension granite), and values indicated by symbol W		XX	293,000 r/	XX	263,000	XX	82,400
Total		XX	351,000 r/	XX	328,000	XX	269,000

p/ Preliminary. r/ Revised. NA Not available. W Withheld to avoid disclosing company proprietary data; value included with "Combined values" data. XX Not applicable.

1/ Production as measured by mine shipments, sales, or marketable production (including consumption by producers).

2/ Data are rounded to three significant digits; may not add to totals shown.

3/ Recoverable content of ores, etc.

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TABLE 2
SOUTH DAKOTA: CRUSHED STONE SOLD OR USED, BY KIND 1/

Kind	1996 Number of quarries	1996 Quantity (thousand metric tons)	1996 Value (thousands)	1996 Unit value	1997 Number of quarries	1997 Quantity (thousand metric tons)	1997 Value (thousands)	1997 Unit value
Limestone	4	2,850	$11,500	$4.05	4	3,110	$11,900	$3.82
Granite	1	1	7	7.00	1	1	13	13.00
Quartzite	7	2,790	17,200	6.16	9	2,790	18,300	6.55
Total	XX	5,640	28,700	5.09	XX	5,900	30,200	5.11

XX Not applicable.
1/ Data are rounded to three significant digits, except unit value; may not add to totals shown.

TABLE 3
SOUTH DAKOTA: CRUSHED STONE SOLD OR USED BY PRODUCERS IN 1997, BY USE 1/ 2/

Use	Quantity (thousand metric tons)	Value (thousands)	Unit value
Coarse aggregate (+1 1/2 inch):			
Riprap and jetty stone	57	$351	$6.16
Filter stone	170	965	5.68
Coarse aggregate, graded:			
Concrete aggregate, coarse	577	3,570	6.19
Bituminous aggregate, coarse	162	694	4.28
Bituminous surface-treatment aggregate	170	1,000	5.89
Railroad ballast	101	581	5.75
Other graded coarse aggregate	8	52	6.50
Fine aggregate (-3/8 inch) 3/	398	1,730	4.36
Coarse and fine aggregates:			
Graded roadbase or subbase	449	1,850	4.12
Crusher run or fill or waste	77	230	2.99
Other construction materials 4/	22	105	4.77
Chemical and metallurgical:			
Cement manufacture	1,130	1,680	1.49
Lime manufacture	W	W	4.52
Glass manufacture	W	W	20.65
Unspecified: 5/			
Actual	W	W	7.39
Estimated	732	4,380	5.99
Total	5,900	30,200	5.11

W Withheld to avoid disclosing company proprietary data; included in "Total."
1/ Includes limestone, quartzite, and granite.
2/ Data are rounded to three significant digits, except unit value; may not add to totals shown.
3/ Includes screening (undesignated) and stone sand (bituminous mix or seal).
4/ Includes unpaved road surfacing.
5/ Includes reported and estimated production without a breakdown by end use.

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TABLE 4
SOUTH DAKOTA: CRUSHED STONE SOLD OR USED BY PRODUCERS IN 1997,
BY USE AND DISTRICT 1/ 2/

(Thousand metric tons and thousand dollars)

Use	District 1		District 3		District 4	
	Quantity	Value	Quantity	Value	Quantity	Value
Construction aggregates:						
Coarse aggregate (+1 1/2 inch) 3/	W	W	--	--	W	W
Coarse aggregate, graded 4/	W	W	--	--	W	W
Fine aggregate (-3/8 inch) 5/	W	W	--	--	W	W
Coarse and fine aggregate 6/	W	W	--	--	W	W
Other construction materials	1,010	4,740	--	--	1,190	6,390
Chemical and metallurgical 7/	1,370	(8/)	--	--	--	--
Unspecified: 9/						
Actual	--	--	578	3,320	(8/)	(8/)
Estimated	732	4,380	--	--	--	--
Total	3,110	11,900	578	3,320	2,210	14,900

W Withheld to avoid disclosing company proprietary data; included with "Other construction materials."
1/ No crushed stone was produced in District 2.
2/ Data are rounded to three significant digits; may not add to totals shown.
3/ Includes filter stone and riprap and jetty stone.
4/ Includes concrete aggregate (coarse), bituminous aggregate (coarse), bituminous surface-treatment aggregate, railroad ballast, and other graded coarse aggregate.
5/ Includes stone sand (bituminous mix or seal), and screening (undesignated).
6/ Includes graded road base or subbase, unpaved road surfacing, crusher run (select material or fill), and coarse and fine aggregates.
7/ Includes cement manufacture, glass manufacture, and lime manufacture.
8/ Withheld to avoid disclosing company proprietary data; included in "Total."
9/ Includes reported and estimated production without a breakdown by end use.

TABLE 5
SOUTH DAKOTA: CONSTRUCTION SAND AND GRAVEL SOLD OR USED IN 1997,
BY MAJOR USE CATEGORY 1/

Use	Quantity (thousand metric tons)	Value (thousands)	Value per ton
Concrete aggregate (including concrete sand) 2/	1,250	$6,050	$4.85
Plaster and gunite sands	50	310	6.20
Asphaltic concrete aggregates and other bituminous mixtures	607	2,440	4.02
Road base and coverings 3/	2,810	8,310	2.96
Fill	966	2,300	2.39
Snow and ice control	51	162	3.18
Other miscellaneous uses 4/	26	189	7.27
Unspecified: 5/			
Actual	715	3,020	4.22
Estimated	3,700	11,300	3.07
Total or average	10,200	34,100	3.36

1/ Data are rounded to three significant digits; may not add to totals shown.
2/ Includes concrete products.
3/ Includes road and other stabilization (cement and lime).
4/ Includes filtration and roofing granules.
5/ Includes reported and estimated production without a breakdown by end use.

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TABLE 6
SOUTH DAKOTA: CONSTRUCTION SAND AND GRAVEL SOLD OR USED IN 1997,
BY USE AND DISTRICT 1/

(Thousand metric tons and thousand dollars)

Use	District 1		District 2	
	Quantity	Value	Quantity	Value
Concrete aggregate and concrete products 2/	--	--	--	--
Asphaltic concrete aggregates and road base materials 3/	548	1,160	1,030	2,740
Fill	W	W	W	W
Snow and ice control	W	W	W	W
Other miscellaneous uses 4/	--	--	--	--
Unspecified: 5/				
Actual	W	W	W	W
Estimated	869	2,370	666	1,930
Total	1,720	4,920	1,940	5,310
	District 3		District 4	
	Quantity	Value	Quantity	Value
Concrete aggregate and concrete products 2/	22	114	1,040	4,980
Asphaltic concrete aggregates and road base materials 3/	629	1,610	1,210	5,260
Fill	305	786	560	1,290
Snow and ice control	W	W	24	45
Other miscellaneous uses 4/	--	--	26	189
Unspecified: 5/				
Actual	W	W	485	2,430
Estimated	1,210	4,220	948	2,820
Total	2,220	6,890	4,290	17,000

W Withheld to avoid disclosing company proprietary data; included in "Total."
1/ Data are rounded to three significant digits; may not add to totals shown.
2/ Includes plaster and gunite sands.
3/ Includes road and other stabilization (cement and lime).
4/ Includes filtration and roofing granules.
5/ Includes reported and estimated production without a breakdown by end use.

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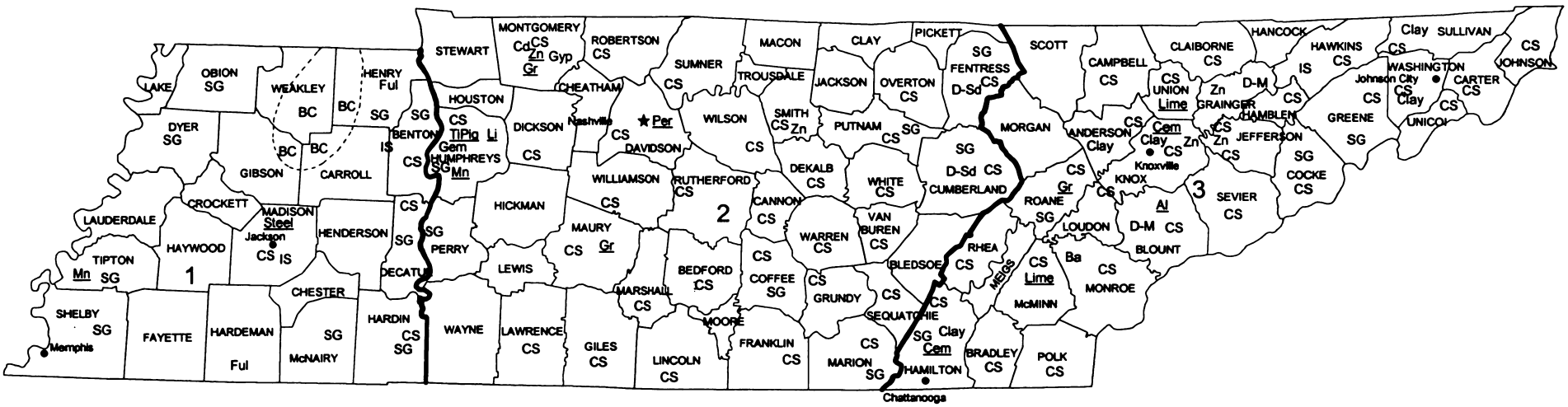
TENNESSEE



LEGEND

- County boundary
- ★ Capital
- ● City
- 1 — Crushed stone/sand and gravel districts

MINERAL SYMBOLS (Major producing areas)

Al	Aluminum plant	CS	Crushed stone	Gyp	Byproduct gypsum	SG	Sand and gravel
Ba	Barite	D-M	Dimension marble	IS	Industrial sand	Steel	Steel plant
BC	Ball clay	D-Sd	Dimension sandstone	Li	Lithium plant	TiPig	Titanium dioxide pigment plant
Cem	Cement plant	Ful	Fuller's earth	Lime	Lime plant	Zn	Zinc
Clay	Clay	Gem	Freshwater pearls and shells	Mn	Manganese dioxide plant	Zn	Zinc refinery (Cd byproduct cadmium) (Ge byproduct germanium)
		Gr	Graphite plant	Per	Perlite plant		

Concentration of mineral operations

0 50 Kilometers

Source: Tennessee Division of Geology/U.S. Geological Survey (1998)

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THE MINERAL INDUSTRY OF TENNESSEE

This chapter has been prepared under a Memorandum of Understanding between the U.S. Geological Survey and the Tennessee Department of Environment and Conservation, Division of Geology, for collecting information on all nonfuel minerals.

In 1998, the preliminary estimated value[1] of nonfuel mineral production for Tennessee was $709 million, according to the U.S. Geological Survey (USGS). This was a marginal increase from that of 1997,[2] and followed a nearly 7% increase in 1997 from that of 1996. Tennessee remained 20th in rank among the 50 States in total nonfuel mineral production value, of which the State accounted for almost 2% of the U.S. total.

Crushed stone has been Tennessee's leading mineral commodity, by value, for more than 25 years, except for 1981 when zinc was first. In 1998, crushed stone accounted for about 54% of the State's total nonfuel mineral production value. Tennessee's increase in value in 1998 mostly resulted from a $35 million rise in the value of crushed stone and from smaller though substantial increases in salt, portland cement, and construction sand and gravel values. (All listings are in descending order of relative change.) The only substantial decrease was a more than $40 million drop in the value of zinc. Most other nonfuel minerals showed relatively small increases. In 1997, crushed stone also led the State's increase that year, rising by $44 million, further supported by significant yet smaller increases (less than $5 million) in portland cement, construction and industrial sand and gravel, and fuller's earth (table 1). Similarly small decreases occurred in zinc, gemstones, ball clay, masonry cement, and lime.

Compared with USGS estimates of the quantities produced in the 50 States in 1998, Tennessee remained the leading[2] gemstone- and ball clay-producing State, second in zinc, and third in barite. The State rose to 10th from 11th in crushed stone and continued as the 10th largest producer of industrial sand and gravel. Additionally, the State's minerals industry produced significant quantities of common clays. Primary aluminum and raw steel were produced in Tennessee but were processed from materials obtained from other domestic and foreign sources. The State ranked 10th in the production of primary aluminum.

The Tennessee Division of Geology provided the following narrative information.[3] The Mascot-Jefferson City's zinc mining industry in East Tennessee, which has had an active history of production since 1854, has experienced significant change over the past few years. ASARCO Incorporated's New Market Mine was on standby, while the company's Young, Immel, and Coy Mines remained active operations. Savage Zinc Co.'s Clinch Valley Mine is expected to remain on standby for a couple of years for exploration and development. In Middle Tennessee, Savage Zinc's Elmwood, Gordonsville, and Cumberland Mines were idled from the end of July until mid-January 1999 because of a strike by the miners.

The East Coast Prospector's Club dropped one of its two leases in the Coker Creek gold district of Monroe County. Club members mine placer gold using portable dredges, sluices, and pans. Coker Creek Village operates a pan for fee for naturally occurring gold. Although the amount of gold recovered is relatively small compared to other gold-producing areas in the United States, the Village's operations have a positive effect on the local tourist economy.

In regard to industrial minerals, Tennessee's crushed stone industry produces limestone and dolomite, with the exception of the Maymead Lime Co., which produces crushed granite in uppermost East Tennessee. The State's major producers include Vulcan Materials Co. with 31 quarries, The Rogers Group with 19 quarries, the American Limestone Co. with 7 quarries, and the Stone Man with 4 quarries. American Limestone also processes and markets tailings from Asarco's Coy Mine. Sand and gravel are dredged from the Tennessee River in the western part of the State by the following companies: Ingram Materials, SanGravl Co., Santana Dredging Co., Teague Brothers Sand and Gravel, Inc., and Tinker Sand and Gravel. Vulcan Materials Co. sold its sand and gravel dredging operation to Ingram Materials. The Bolivar Sand Co. dredged sand from its pits in and around Bolivar, Hardeman County. The Nolichucky Sand Co. and the Newport Sand and Gravel Co. in East Tennessee produce crushed stone from alluvial deposits consisting of quartzite and sandstone.

Oglebay Norton Co. acquired the high-calcium limestone mine at Luttrell, northeast of Knoxville, from the previous operator, Global Stone Inc. (formerly Global Stone Tennessee Luttrell, Inc.).

High-silica sand, chiefly for the glass industry, was mined and processed from sandstone by Short Mountain Silica in

[1]The terms "nonfuel mineral production" and related "values" encompass variations in meaning, depending on the minerals or mineral products. Production may be measured by mine shipments, mineral commodity sales, or marketable production (including consumption by producers) as is applicable to the individual mineral commodity.

All 1998 USGS mineral production data published in this chapter are preliminary estimates as of February 1999 and are expected to change. For some mineral commodities (for example, construction sand and gravel, crushed stone, and portland cement), estimates are updated periodically. To obtain the most current information, please contact the appropriate USGS mineral commodity specialist. A telephone listing for the specialists may be retrieved over the Internet at http://minerals.usgs.gov/minerals/contacts/comdir.html; by using MINES FaxBack at (703) 648-4999 from a fax machine with a touch-tone handset (request Document #1000 for a telephone listing of all mineral commodity specialists); or by calling USGS information at (703) 648-4000 for the specialist's name and number. All Mineral Industry Surveys—mineral commodity, State, and country—also may be retrieved over the Internet at http://minerals.usgs.gov/minerals; facsimile copies may be obtained from MINES FaxBack.

[2]Values, percentage calculations, and rankings for 1997 may vary from the *Minerals Yearbook, Area Reports: Domestic 1997, Volume II*, owing to the revision of preliminary 1997 to final 1997 data. Data for 1998 are preliminary and expected to change, while related rankings may also be subject to change.

[3]Robin C. Hale, Chief Geologist with the Tennessee Division of Geology in Knoxville, authored the text of mineral industry information submitted by that agency.

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East Tennessee and by Tennessee Silica (a subsidiary of Unimin Corp.) at its pits in West Tennessee.

Tennessee's clay industry continued to be very active in 1998. Four companies mined and processed ball clay and kaolin in western Tennessee: H.C. Spinks Co., Kentucky-Tennessee Clay Co., Old Hickory Clay Co., and United Clays, Inc. Gleason Brick Co. mined clay and shale to supply its brick plants in the eastern portion of the State at Chattanooga, Johnson City, and Knoxville.

The Tennessee Marble Co. quarries marble for dimension stone and tile at its Friendsville quarry in Blount County, and the Imperial Black Marble Co. produces dimension stone at its Thorn Hill quarry in Grainger County. Quartzitic sandstone is quarried on the Cumberland Plateau for dimension stone, flagstone, rough broken stone, ashlar, and rubble. Although there are a number of individuals who independently quarry the sandstone, the three companies that quarried, sawed, and fabricated sandstone were the Cumberland Mountain Stone Co., Silvara Stone Co., and Tennessee Building Stone, Inc. Independent operators also gather rough field stone for decorative purposes.

The American Shell Co. harvests clams from the Tennessee River and exports the shells that are crushed and used for seeds for Japan's cultured-pearl industry.

TABLE 1
NONFUEL RAW MINERAL PRODUCTION IN TENNESSEE 1/ 2/

(Thousand metric tons and thousand dollars unless otherwise specified)

Mineral	1996		1997 r/		1998 p/	
	Quantity	Value	Quantity	Value	Quantity	Value
Clays:						
Ball	679	29,000	659	27,400	679	28,800
Kaolin	32	W	W	W	--	--
Gemstones	NA	12,900	NA	9,740	NA	10,000
Sand and gravel:						
Construction	8,380	35,300	8,650	39,500	9,070	42,600
Industrial	747	13,900	898	16,500	890	15,100
Stone: Crushed	55,100	305,000	60,400	349,000	64,000	384,000
Combined values of barite, cement, clays (common, fuller's earth), copper (1996-97), lead, lime, salt (1998), silver, stone (dimension marble), zinc, and values indicated by symbol W	XX	265,000 r/	XX	265,000	XX	228,000
Total	XX	661,000 r/	XX	707,000	XX	709,000

p/ Preliminary. r/ Revised. NA Not available. W Withheld to avoid disclosing company proprietary data; value included with "Combined values" data. XX Not applicable.

1/ Production as measured by mine shipments, sales, or marketable production (including consumption by producers).

2/ Data are rounded to three significant digits; may not add to totals shown.

TABLE 2
TENNESSEE: CRUSHED STONE SOLD OR USED, BY KIND 1/

Kind	1996				1997			
	Number of quarries	Quantity (thousand metric tons)	Value (thousands)	Unit value	Number of quarries	Quantity (thousand metric tons)	Value (thousands)	Unit value
Limestone	105	49,500	$275,000	$5.55	108	54,300	$316,000	$5.82
Dolomite	11	W	W	5.45	10	W	W	5.49
Granite	1	W	W	4.54	1	W	W	4.65
Sandstone	2	W	W	6.51	2	W	W	7.01
Total	XX	55,100	305,000	5.53	XX	60,400	349,000	5.79

W Withheld to avoid disclosing proprietary data; included in "Total." XX Not applicable.

1/ Data are rounded to three significant digits; may not add to totals shown.

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TABLE 3
TENNESSEE: CRUSHED STONE SOLD OR USED BY PRODUCERS
IN 1997, BY USE 1/ 2/

Use	Quantity (thousand metric tons)	Value (thousands)	Unit value
Coarse aggregate (+1 1/2 inch):			
Riprap and jetty stone	1,200	$6,920	$5.79
Filter stone	681	3,800	5.58
Other coarse aggregate 3/	647	5,210	8.06
Coarse aggregate, graded:			
Concrete aggregate, coarse	3,370	18,800	5.58
Bituminous aggregate, coarse	12,700	74,700	5.86
Bituminous surface-treatment aggregate	1,450	9,200	6.33
Railroad ballast	500	2,510	5.02
Other graded coarse aggregate	2,240	16,100	7.19
Fine aggregate (-3/8 inch):			
Stone sand, concrete	966	7,870	8.14
Stone sand, bituminous mix or seal	468	2,920	6.23
Screening, undesignated	2,730	17,100	6.28
Other fine aggregate	313	2,080	6.64
Coarse and fine aggregates:			
Graded road base or subbase	13,700	73,500	5.36
Unpaved road surfacing	288	1,080	3.76
Crusher run or fill or waste	2,140	10,500	4.92
Other coarse and fine aggregates	681	5,870	8.61
Other construction materials 4/	476	1,950	4.10
Agricultural:			
Agricultural limestone	529	3,570	6.74
Poultry grit and mineral food	25	343	13.72
Other agricultural uses	1	20	20.00
Chemical and metallurgical:			
Cement manufacture	W	W	W
Lime manufacture	593	9,800	16.53
Sulfur oxide removal	W	W	W
Special:			
Mine dusting or acid water treatment	6	130	21.67
Other fillers or extenders	188	2,790	14.86
Other miscellaneous uses: Waste material	52	58	1.12
Unspecified: 5/			
Actual	6,740	32,400	4.80
Estimated	6,090	32,200	5.29
Total	60,400	349,000	5.79

W Withheld to avoid disclosing company proprietary data; included in "Total."
1/ Includes dolomite, granite, limestone, miscellaneous stone, and sandstone.
2/ Data are rounded to three significant digits, except unit value; may not add to totals shown.
3/ Includes macadam.
4/ Includes terrazzo and exposed aggregate.
5/ Includes reported and estimated production without a breakdown by end use.

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TABLE 4
TENNESSEE: CRUSHED STONE SOLD OR USED BY PRODUCERS IN 1997,
BY USE AND DISTRICT 1/

(Thousand metric tons and thousand dollars)

Use	District 1		District 2		District 3	
	Quantity	Value	Quantity	Value	Quantity	Value
Construction aggregates:						
Coarse aggregate (+1 1/2 inch) 2/	W	W	1,760	8,900	757	4,720
Coarse aggregate, graded 3/	W	W	9,360	52,400	8,280	49,200
Fine aggregate (-3/8 inch) 4/	W	W	1,790	10,500	2,170	15,800
Coarse and fine aggregate 5/	W	W	7,470	37,000	7,120	42,100
Other construction materials 6/	--	--	W	W	W	W
Agricultural 7/	W	W	192	1,070	43	459
Chemical and metallurgical 8/	--	--	W	W	W	W
Special 9/	--	--	--	--	194	2,920
Unspecified: 10/						
Actual	--	--	4,540	22,700	2,200	9,650
Estimated	850	3,680	3,110	18,000	2,130	10,500
Total	7,040	44,200	28,800	153,000	24,500	152,000

W Withheld to avoid disclosing company proprietary data; included in "Total."
1/ Data are rounded to three significant digits; may not add to totals shown.
2/ Includes filter stone, macadam, riprap and jetty stone, and other coarse aggregate.
3/ Includes concrete aggregate (coarse), bituminous aggregate (coarse), bituminous surface-treatment aggregate, railroad ballast, and other graded coarse aggregate.
4/ Includes stone sand (concrete), stone sand (bituminous mix or seal), and screening (undesignated).
5/ Includes graded road base or subbase, unpaved road surfacing, crusher run (select material or fill), terrazzo and exposed aggregate, and other coarse and fine aggregates.
6/ Includes waste material.
7/ Includes agricultural limestone, poultry grit and mineral food, and other agricultural uses.
8/ Includes cement manufacture, lime manufacture, and sulfur oxide removal.
9/ Includes mine dusting or acid water treatment and other fillers or extenders.
10/ Includes reported and estimated production without a breakdown by end use.

TABLE 5
TENNESSEE: CONSTRUCTION SAND AND GRAVEL SOLD OR USED IN 1997,
BY MAJOR USE CATEGORY 1/

Use	Quantity (thousand metric tons)	Value (thousands)	Value per ton
Concrete aggregate (including concrete sand) 2/	2,770	$14,700	$5.31
Concrete products (blocks, bricks, pipe, decorative, etc.)	236	1,180	4.98
Asphaltic concrete aggregates and other bituminous mixtures	1,060	5,560	5.24
Road base and coverings 3/	1,310	4,710	3.59
Fill	41	215	5.24
Other miscellaneous uses 4/	25	227	9.08
Unspecified: 5/			
Actual	886	4,370	4.93
Estimated	2,320	8,520	3.67
Total or average	8,650	39,500	4.56

1/ Data are rounded to three significant digits; may not add to totals shown.
2/ Includes plaster and gunite sands.
3/ Includes road and other stabilization (cement).
4/ Includes filtration and railroad ballast.
5/ Includes reported and estimated production without a breakdown by end use.

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TABLE 6

TENNESSEE: CONSTRUCTION SAND AND GRAVEL SOLD OR USED IN 1997, BY USE AND DISTRICT 1/

(Thousand metric tons and thousand dollars)

Use	District 1		District 2		District 3	
	Quantity	Value	Quantity	Value	Quantity	Value
Concrete aggregate and concrete products 2/	1,700	8,410	W	W	W	W
Asphaltic concrete aggregates and other bituminous mixtures	745	3,270	185	917	130	1,370
Road base and coverings 3/	962	2,620	W	W	W	W
Other miscellaneous uses 4/	W	W	21	149	W	W
Unspecified: 5/						
Actual	W	W	W	W	--	--
Estimated	1,720	5,270	225	1,140	379	2,120
Total	5,780	22,600	1,860	9,230	1,000	7,860

W Withheld to avoid disclosing company proprietary data; included in "Total."
1/ Data are rounded to three significant digits; may not add to totals shown.
2/ Includes plaster and gunite sands.
3/ Includes road and other stabilization (cement).
4/ Includes fill, filtration, and railroad ballast.
5/ Includes reported and estimated production without a breakdown by end use.

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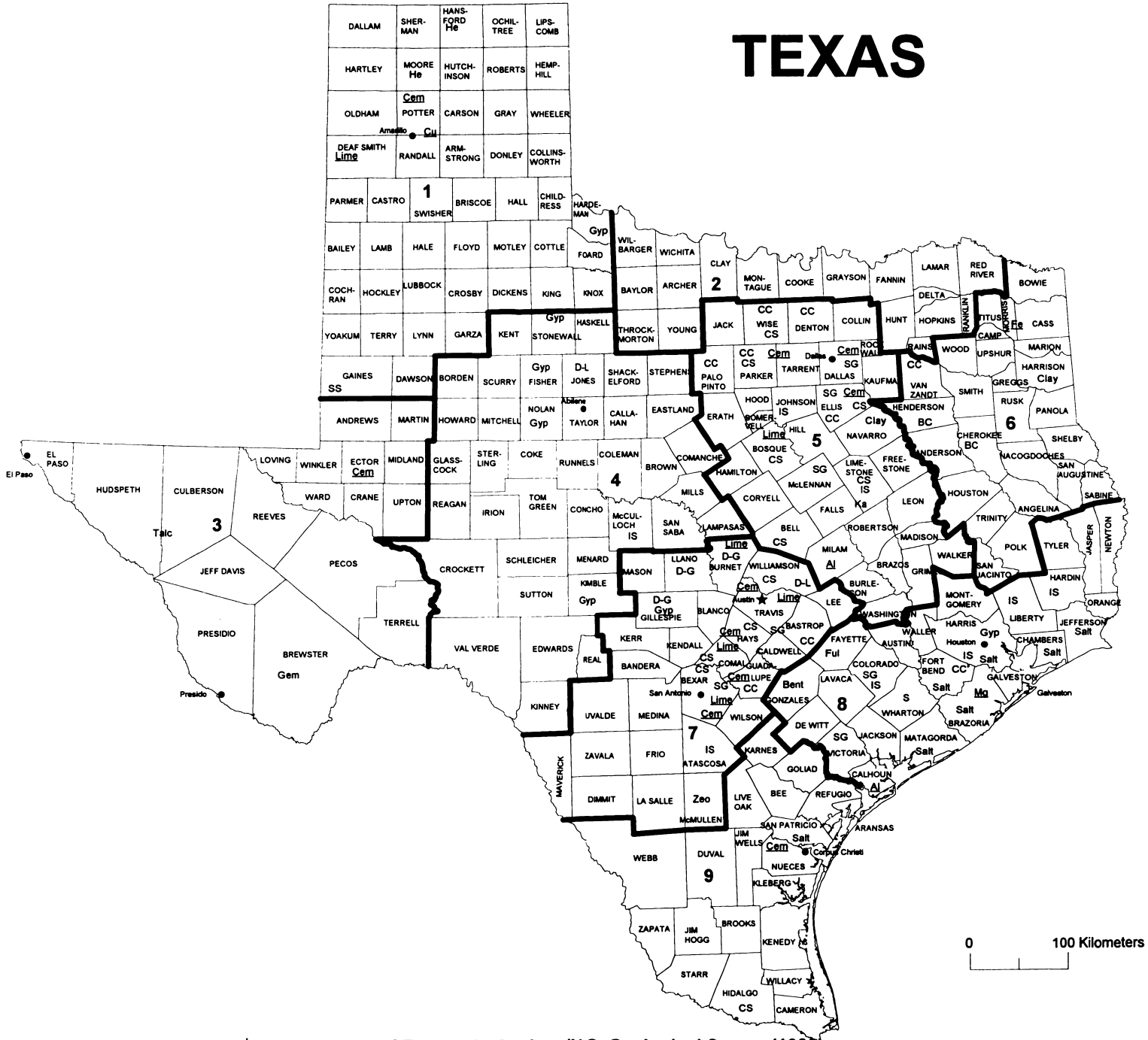
TEXAS



LEGEND

- County boundary
- ★ Capital
- ● City
- 1 ——— Crushed stone/sand and gravel districts

MINERAL SYMBOLS
(Major producing areas)

Al	Aluminum plant
BC	Ball clay
Bent	Bentonite
Cem	Cement plant
CC	Common clay
CS	Crushed stone
Cu	Copper plant
D-G	Dimension granite
D-L	Dimension limestone
Fe	Iron ore and/or scrap steel plant
Ful	Fuller's earth
Gem	Gemstones
Gyp	Gypsum
He	Helium
IS	Industrial sand
Ka	Kaolin
Lime	Lime plant
Mg	Magnesium metal from seawater
S	Sulfur
Salt	Salt
SG	Sand and gravel
SS	Sodium saltate
Talc	Talc
Zeo	Zeolites

Source: University of Texas at Austin, Bureau of Economic Geology/U.S. Geological Survey (1998)

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THE MINERAL INDUSTRY OF TEXAS

This chapter has been prepared under a Memorandum of Understanding between the U.S. Geological Survey and the University of Texas at Austin, Bureau of Economic Geology, for collecting information on all nonfuel minerals.

In 1998, the preliminary estimated value[1] of nonfuel mineral production for Texas was $1.92 billion, according to the U.S. Geological Survey (USGS). This was nearly an 8% increase from that of 1997,[2] following about a 2.9% increase from 1996 to 1997. For the second consecutive year, Texas ranked fifth in the Nation in total nonfuel mineral production value, of which the State accounted for almost 5% of the U.S. total.

Nearly 83% of Texas' nonfuel mineral value came from the production of the State's top five industrial minerals, in descending order of value: portland cement, crushed stone, construction sand and gravel, lime, and salt. (The following mineral listings are in descending order of relative change in value.) In 1998, significant increases in the values of crushed stone, construction sand and gravel, and portland cement, plus a relatively moderate increase in industrial sand and gravel provided most of the State's overall rise in value (table 1). This was mitigated somewhat by decreases in the values of Frasch sulfur, magnesium metal, natural sodium sulfate, and grade-A helium. In November, Dow Chemical Co. shut down magnesium metal production at its Freeport plant (Olafson, 1998, p. 2c). Dow concluded that damage from recent storms had resulted in continued production problems and costs had become too high to keep the operation going. This affected 200 Dow employees at the plant and 300 contract workers. Most other nonfuel minerals increased in value except talc, kaolin, salt, dimension stone, and fuller's earth, all of which showed small decreases; gemstones and ball clay remained unchanged.

In 1997, portland cement, industrial sand and gravel, Frasch sulfur, and construction sand and gravel value increases contributed the most to Texas $50 million net increase in total value. Increases of more than $2 million each occurred in lime, crude gypsum, natural sodium sulfate, and salt. Only magnesium metal, dimension stone, and crushed stone showed significant decreases for the year. All other changes were smaller and inconsequential to the State's net change in value.

Based on USGS estimates of the quantities of minerals produced in the 50 States in 1998, Texas climbed in rank to 1st[2] from 2d in crushed stone, to 2d from 3d in construction sand and gravel, and to 10th from 12th in dimension stone. The State remained first of three magnesium metal-producing States; second in portland cement, salt, crude gypsum, talc, and zeolites (this listing and those to follow are in descending order of value); second in each of two Frasch sulfur-, two sodium sulfate-, and three crude helium-producing States; and virtually tied for second in ball clay. The State continued to rank third in common clays and grade-A helium; fourth in industrial sand and gravel; sixth in lime and magnesium compounds; and eighth in masonry cement. Production of greensand marl commenced in 1998, and Texas was second of two producing States.

Magnesium metal, extracted from seawater, was the only metal produced from the State's natural resources. In addition to the production of magnesium metal, the Texas metal industry produced raw steel, primary aluminum, copper, lead, and smaller amounts of other metals. Sources of plant feed included scrap metal and ores acquired from other domestic or foreign sources. Texas produced an estimated 4.24 million metric tons of raw steel, as reported by the American Iron and Steel Institute. Based on USGS data, the State ranked ninth in primary aluminum production.

A Mexican group purchased the bankrupt Border Steels Rolling Mills of El Paso and its in-house scrap company, Metals Processing. Grupo Villacero is leading a consortium that includes two prominent families of Houston. A 2-year, $20 million investment plan is expected to increase the melt shop capacity to 400,000 tons (Steel Times International, 1998). North Star Steel Co. announced the elimination of 185 jobs, almost one-third of its workforce, at its rod mill in Beaumont, effective November 24. The company cited an unusually great influx of imported wire rod (New Steel, 1998).

The following narrative information was provided by the Texas Bureau of Economic Geology (BEG).[3]

The Texas' nonfuel mineral industry continued to grow during 1998, especially in the construction sectors. The increase in population and growth in industry spurred activity in mineral production by creating a demand for materials used in developing infrastructure. Production of aggregates and other industrial minerals needed for manufacturing building products responded to changes in construction activity.

According to the Texas Workforce Commission, employment in construction and manufacturing industries related to mineral products showed increases during 1998. The annual growth rate for jobs in construction was 4.9%. Jobs related to stone, clay, and glass products increased by

[1]The terms "nonfuel mineral production" and related "values" encompass variations in meaning, depending on the minerals or mineral products. Production may be measured by mine shipments, mineral commodity sales, or marketable production (including consumption by producers) as is applicable to the individual mineral commodity.

All 1998 USGS mineral production data published in this chapter are preliminary estimates as of February 1999 and are expected to change. For some mineral commodities (for example, construction sand and gravel, crushed stone, and portland cement), estimates are updated periodically. To obtain the most current information, please contact the appropriate USGS mineral commodity specialist. A telephone listing for the specialists may be retrieved over the Internet at http://minerals.usgs.gov/minerals/contacts/comdir.html; by using MINES FaxBack at (703) 648-4999 from a fax machine with a touch-tone handset (request Document #1000 for a telephone listing of all mineral commodity specialists); or by calling USGS information at (703) 648-4000 for the specialist's name and number. All Mineral Industry Surveys—mineral commodity, State, and country—also may be retrieved over the Internet at http://minerals.usgs.gov/minerals; facsimile copies may be obtained from MINES FaxBack.

[2]Values, percentage calculations, and rankings for 1997 may vary from the *Minerals Yearbook, Area Reports: Domestic 1997, Volume II*, owing to the revision of preliminary 1997 to final 1997 data. Data for 1998 are preliminary and expected to change, while related rankings may also be subject to change.

[3]L. Edwin Garner, Research Associate, authored the text of mineral industry information submitted by the Texas Bureau of Economic Geology.

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3.8% and those related to concrete, gypsum, and plaster products increased by about 5.6% from December 1997 through December 1998. However, annual job growth in nonfuel and fuel mineral mining combined decreased 3.3% from December 1997 through December 1998 (Griffis, 1998). Persistently low crude oil prices affected the mining, construction, and manufacturing industries in Texas that support drilling activities. This overall decrease was the result of extensive layoffs in the oil and gas industries.

Exploration for nonfuel minerals in Texas showed no significant increase during 1998. The BEG, however, received several inquiries about possible sources of clays, industrial sands, limestone, and sand and gravel materials.

Overall, activity in the nonfuel mineral industry was above average during 1998. According to the BEG, the current trends of continually increasing population and commercial development support its projection that production of the State's mineral resources used in infrastructure will continue to grow in the near future.

References Cited

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TABLE 1
NONFUEL RAW MINERAL PRODUCTION IN TEXAS 1/ 2/

(Thousand metric tons and thousand dollars unless otherwise specified)

Mineral		1996 Quantity	1996 Value	1997 Quantity	1997 Value	1998 p/ Quantity	1998 p/ Value
Cement:							
Masonry		216	20,300 e/	203	18,900 e/	207	19,900
Portland		8,240	532,000 e/	8,280	576,000 e/	8,580	610,000
Clays:							
Ball		101	W	W	W	W	W
Common		2,290	15,000	2,150	13,600	2,200	13,800
Kaolin		28	W	35	7,600	W	W
Gemstones		NA	511	NA	11	NA	11
Gypsum, crude		2,240	12,100	2,260	15,700	2,250	16,300
Lime		1,360	87,100 r/	1,470	91,500	1,520	91,900
Salt		9,700	88,900	9,780	91,000	9,700	89,800
Sand and gravel:							
Construction		61,300	278,000	60,100	284,000	67,500	328,000
Industrial		1,420	38,200	1,830	48,800	1,870	55,500
Stone:							
Crushed		86,400 r/	341,000	81,000 r/	338,000 r/	93,000	465,000
Dimension	metric tons	86,600	21,100	35,300	11,300	35,000	11,200
Talc and pyrophyllite	do.	225,000	5,100	274,000	6,760	W	W
Zeolites	do.	W	NA	W	NA	NA	NA
Combined values of clays [bentonite (1997-98), fuller's earth], greensand marl, helium, magnesium compounds, magnesium metal, sodium sulfate (natural), sulfur (Frasch), and values indicated by symbol W		XX	293,000	XX	281,000	XX	223,000
Total		XX	1,730,000	XX	1,780,000 r/	XX	1,920,000

e/ Estimated. p/ Preliminary. r/ Revised. NA Not available. W Withheld to avoid disclosing company proprietary data; value included with "Combined values" data. XX Not applicable.

1/ Production as measured by mine shipments, sales, or marketable production (including consumption by producers).

2/ Data are rounded to three significant digits; may not add to totals shown.

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TABLE 2

TEXAS: CRUSHED STONE SOLD OR USED, BY KIND 1/

Kind	1996 Number of quarries	1996 Quantity (thousand metric tons)	1996 Value (thousands)	1996 Unit value	1997 Number of quarries	1997 Quantity (thousand metric tons)	1997 Value (thousands)	1997 Unit value
Limestone	118	82,500	$323,000	$3.92	109	77,400	$322,000	$4.16
Dolomite	1	W	W	2.95	1	W	W	3.06
Marble	28	W	W	20.56	11	W	W	20.33
Calcareous marl	2	W	W	2.27	2	W	W	2.24
Granite	2	W	W	6.25	2	W	W	6.02
Traprock	2	W	W	6.69	1	W	W	7.44
Sandstone	5	746	5,090	6.82	5	709	4,910	6.92
Volcanic cinder	2	W	W	4.45	1	156	809	5.19
Miscellaneous stone	3	W r/	W r/	2.38 r/	3	W	W	2.46
Total	XX	86,400 r/	341,000 r/	3.94 r/	XX	81,000	338,000	4.17

r/ Revised. W Withheld to avoid disclosing company proprietary data; included in "Total." XX Not applicable.
1/ Data are rounded to three significant digits, except unit value; may not add to totals shown.

TABLE 3

TEXAS: CRUSHED STONE SOLD OR USED BY PRODUCERS IN 1997, BY USE 1/ 2/

Use	Quantity (thousand metric tons)	Value (thousands)	Unit value
Coarse aggregate (+1 1/2 inch):			
Riprap and jetty stone	297	$2,090	$7.03
Filter stone	468	3,680	7.87
Other coarse aggregate 3/	1,570	5,380	3.43
Coarse aggregate, graded:			
Concrete aggregate, coarse	12,300	64,900	5.29
Bituminous aggregate, coarse	5,010	31,300	6.24
Bituminous surface-treatment aggregate	846	5,660	6.68
Other graded coarse aggregate 4/	4,780	24,900	5.22
Fine aggregate (-3/8 inch):			
Stone sand, concrete	4,130	14,900	3.62
Stone sand, bituminous mix or seal	1,420	10,300	7.25
Screening, undesignated	889	2,100	2.36
Other fine aggregate	144	399	2.77
Coarse and fine aggregates:			
Graded road base or subbase	17,800	63,000	3.54
Unpaved road surfacing	159	343	2.16
Terrazzo and exposed aggregate	3	157	52.33
Crusher run or fill or waste	2,780	7,590	2.73
Other coarse and fine aggregates	1,960	5,260	2.68
Other construction materials	110	614	5.58
Agricultural: Other agricultural uses 5/	439	3,410	7.77
Chemical and metallurgical:			
Cement manufacture	11,500	30,900	2.68
Lime manufacture	1,240	6,360	5.15
Flux stone	W	W	6.33
Sulfur oxide removal	W	W	4.53
Special:			
Asphalt fillers or extenders	W	W	10.42
Whiting or whiting substitute	W	W	22.94
Other fillers or extenders	449	3,500	7.78
Unspecified: 6/			
Actual	2,680	8,270	3.09
Estimated	9,130	28,100	3.08
Total	81,000	338,000	4.17

W Withheld to avoid disclosing company proprietary data; included in "Total."
1/ Includes calcareous marl, dolomite, granite, limestone, marble, miscellaneous stone, sandstone, traprock, and volcanic cinder and scoria.
2/ Data are rounded to three significant digits, except unit value; may not add to totals shown.
3/ Includes macadam.
4/ Includes railroad ballast.
5/ Includes agricultural limestone and poultry grit and mineral food.
6/ Includes reported and estimated production without a breakdown by end use.

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TABLE 4
TEXAS: CRUSHED STONE SOLD OR USED BY PRODUCERS IN 1997,
BY USE AND DISTRICT 1/ 2/

(Thousand metric tons and thousand dollars)

	District 1		District 2		District 3	
Use	Quantity	Value	Quantity	Value	Quantity	Value
Construction aggregates:						
Coarse aggregate (+1 1/2 inch) 3/	(4/)	3	W	W	W	W
Coarse aggregate, graded 5/	65	432	W	W	W	W
Fine aggregate (-3/8 inch) 6/	5	30	W	W	W	W
Coarse and fine aggregate 7/	9	100	W	W	W	W
Other construction materials	--	--	288	1,780	848	6,070
Agricultural 8/	--	--	--	--	--	--
Chemical and metallurgical 9/	--	--	--	--	(10/)	(10/)
Special 11/	--	--	--	--	--	--
Unspecified 12/						
Actual	--	--	--	--	--	--
Estimated	866	2,630	221	791	(10/)	(10/)
Total	946	3,200	509	2,570	3,180	13,500

	District 4		District 5		District 6	
	Quantity	Value	Quantity	Value	Quantity	Value
Construction aggregates:						
Coarse aggregate (+1 1/2 inch) 3/	W	W	W	W	24	168
Coarse aggregate, graded 5/	W	W	11,900	59,400	--	--
Fine aggregate (-3/8 inch) 6/	W	W	3,050	8,430	--	--
Coarse and fine aggregate 7/	W	W	3,720	13,900	132	641
Other construction materials	2,020	9,260	--	--	--	--
Agricultural 8/	--	--	(10/)	(10/)	--	--
Chemical and metallurgical 9/	495	1,830	5,210	15,200	--	--
Special 11/	--	--	(10/)	(10/)	--	--
Unspecified 12/						
Actual	--	--	1,190	5,520	--	--
Estimated	1,010	2,580	3,310	8,650	38	104
Total	3,520	13,700	29,500	124,000	194	913

	District 7		District 9		Unspecified districts	
Use	Quantity	Value	Quantity	Value	Quantity	Value
Construction aggregates:						
Coarse aggregate (+1 1/2 inch) 3/	2,250	10,400	--	--	--	--
Coarse aggregate, graded 5/	9,610	58,900	--	--	--	--
Fine aggregate (-3/8 inch) 6/	3,230	17,900	--	--	--	--
Coarse and fine aggregate 7/	15,300	49,900	2,170	6,670	--	--
Other construction materials	(10/)	(10/)	70	212	--	--
Agricultural 8/	(10/)	(10/)	--	--	--	--
Chemical and metallurgical 9/	6,400	18,100	--	--	--	--
Special 11/	(10/)	(10/)	--	--	--	--
Unspecified 12/						
Actual	(10/)	(10/)	(10/)	(10/)	--	--
Estimated	1,900	5,830	(10/)	(10/)	15	44
Total	40,800	173,000	2,370	7,270	15	44

W Withheld to avoid disclosing company proprietary data; included with "Other construction materials."
1/ Data are rounded to three significant digits; may not add to totals shown.
2/ No crushed stone produced in District 8.
3/ Includes filter stone, macadam, riprap and jetty stone, and other coarse aggregate.
4/ Less than 1/2 unit.
5/ Includes concrete aggregate (coarse), bituminous aggregate (coarse), bituminous surface-treatment aggregate, railroad ballast, and other graded coarse aggregate.
6/ Includes stone sand (concrete), stone sand (bituminous mix or seal), screening (undesignated), and other fine aggregate.
7/ Includes graded road base or subbase, terrazzo and exposed aggregate, unpaved road surfacing, crusher run (select material or fill), and other coarse and fine aggregates.
8/ Includes agricultural limestone, poultry grit and mineral food, and other agricultural uses.
9/ Includes cement manufacture, flux stone, lime manufacture, and sulfur oxide removal.
10/ Withheld to avoid disclosing company proprietary data; included in "Total."
11/ Includes asphalt fillers or extenders, other fillers or extenders, and whiting or whiting substitute.
12/ Includes reported and estimated production without a breakdown by end use.

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TABLE 5

TEXAS: CONSTRUCTION SAND AND GRAVEL SOLD OR USED IN 1997, BY MAJOR USE CATEGORY 1/

Use	Quantity (thousand metric tons)	Value (thousands)	Value per ton
Concrete aggregate and concrete products	23,100	$115,000	$4.98
Plaster and gunite sands	395	2,010	5.08
Asphaltic concrete aggregates and other bituminous mixtures	1,660	9,810	5.90
Road base and coverings	1,820	6,390	3.52
Road stabilization (cement)	1,360	4,300	3.17
Road stabilization (lime)	6	11	1.83
Fill	5,540	10,900	1.97
Roofing granules	75	941	12.55
Filtration	66	1,090	16.55
Other miscellaneous uses	336	2,290	6.83
Unspecified: 2/			
Actual	9,250	47,400	5.13
Estimated	16,500	83,800	5.07
Total or average	60,100	284,000	4.72

1/ Data are rounded to three significant digits, except value per ton; may not add to totals shown.
2/ Includes reported and estimated production without a breakdown by end use.

TABLE 6

TEXAS: CONSTRUCTION SAND AND GRAVEL SOLD OR USED IN 1997, BY USE AND DISTRICT 1/

(Thousand metric tons and thousand dollars)

Use	District 1		District 2		District 3		District 4	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
Concrete aggregate and concrete products 2/	888	5,420	W	W	W	W	W	W
Asphaltic concrete aggregates and road base materials 3/	1,200	7,480	--	--	W	W	21	139
Other miscellaneous uses 4/	166	615	W	W	--	--	W	W
Unspecified: 5/								
Actual	--	--	--	--	--	--	W	W
Estimated	1,210	5,270	10	68	173	835	1,520	8,760
Total	3,470	18,800	1,050	7,260	888	3,910	1,950	12,000

Use	District 5		District 6		District 7		District 8	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
Concrete aggregate and concrete products 2/	5,950	34,300	W	W	1,830	8,600	10,400	42,200
Asphaltic concrete aggregates and road base materials 3/	319	1,380	W	W	413	1,740	2,480	7,290
Other miscellaneous uses 4/	1,460	4,670	W	W	1,090	3,120	W	W
Unspecified: 5/								
Actual	6,580	33,100	--	--	1,580	8,880	W	W
Estimated	2,930	14,000	751	4,300	1,320	5,090	5,220	25,400
Total	17,200	87,400	968	5,220	6,220	27,400	21,500	82,400

Use	District 9		Unspecified districts	
	Quantity	Value	Quantity	Value
Concrete aggregate and concrete products 2/	W	W	--	--
Asphaltic concrete aggregates and road base materials 3/	W	W	--	--
Other miscellaneous uses 4/	--	--	--	--
Unspecified: 5/				
Actual	--	--	750	3,480
Estimated	3,400	20,100	--	--
Total	6,060	36,200	750	3,480

W Withheld to avoid disclosing company proprietary data; included in "Total."
1/ Data are rounded to three significant digits; may not add to totals shown.
2/ Includes plaster and gunite sands.
3/ Includes road and other stabilization (cement and lime).
4/ Includes fill, filtration, and roofing granules.
5/ Includes reported and estimated production without a breakdown by end use.

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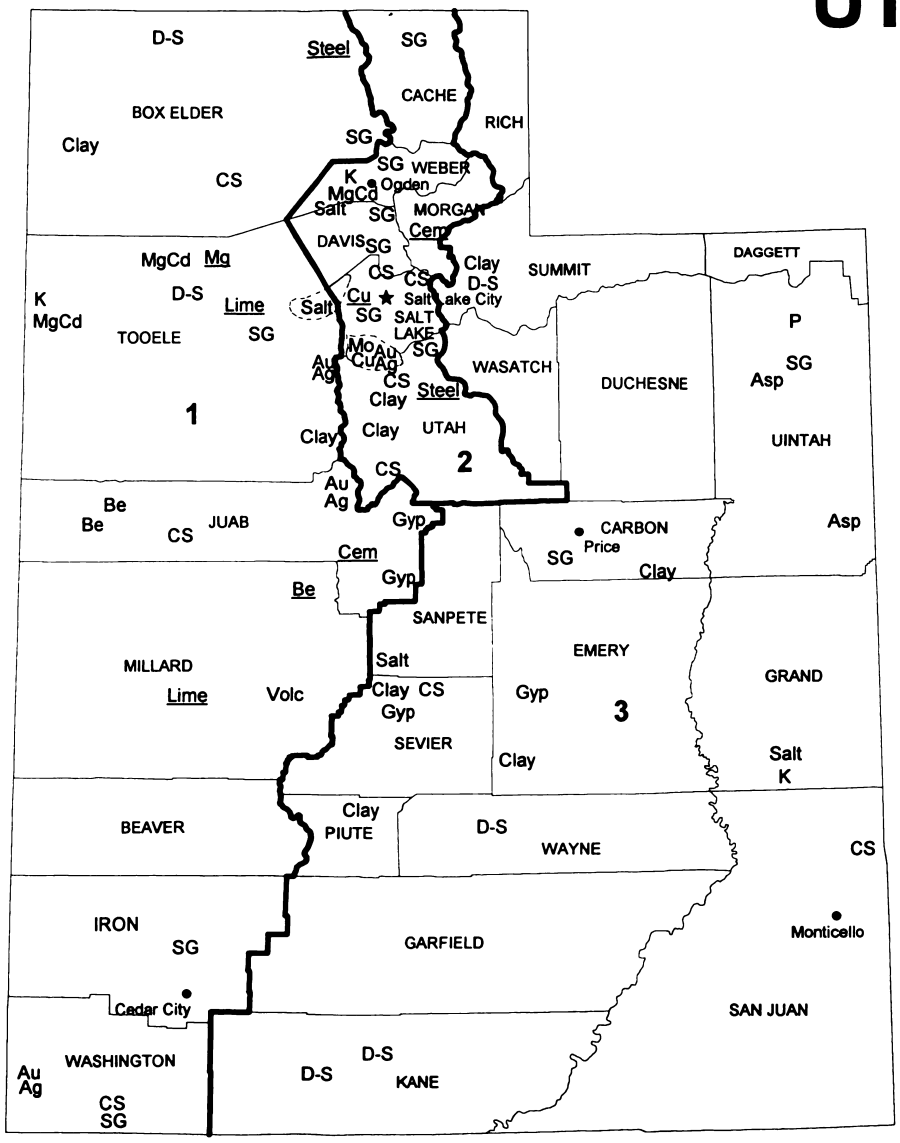
UTAH



LEGEND

- County boundary
- ★ Capital
- • City
- 1 Crushed stone/sand and gravel districts

MINERAL SYMBOLS
(Major producing areas)

Ag	Silver
Asp	Asphaltite
Au	Gold
Be	Beryllium
Be	Beryllium plant
Cem	Cement plant
Clay	Clay
CS	Crushed stone
Cu	Copper
Cu	Copper plant
D-S	Dimension sandstone
Gyp	Gypsum
K	Potash
Lime	Lime plant
MgCd	Magnesium compounds
Mg	Magnesium metal plant
Mo	Molybdenum
P	Phosphate rock
Salt	Salt
SG	Sand and gravel
Steel	Iron and steel plant
Volc	Volcanic cinders
⬭	Concentration of mineral operations

0 — 100 Kilometers

Source: Utah Geological Survey/U.S. Geological Survey (1998)

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THE MINERAL INDUSTRY OF UTAH

This chapter has been prepared under a Memorandum of Understanding between the U.S. Geological Survey and the Utah Geological Survey for collecting information on all nonfuel minerals.

In 1998, the preliminary estimated value[1] of nonfuel mineral production for Utah was $1.3 billion, according to the U.S. Geological Survey (USGS). This was a 23% decrease from that of 1997,[2] following a 3% decrease from 1996 to 1997. The State dropped from 8th to 10th among the 50 States in total nonfuel mineral production value, of which Utah accounted for 3.25% of the U.S. total.

In 1998, the decrease in Utah's nonfuel mineral production value (table 1) was mainly attributable to declines in the value of copper (31%), gold (55%), magnesium metal (4%), molybdenum (44%), and salt (5%). Offsetting this were increases in the value of construction sand and gravel (26%), crushed stone (8%), magnesium compounds (56%), portland cement (6%), and potash (8%).

Based on USGS estimates of quantities produced in the 50 States during 1998, Utah remained the only State to produce beryllium concentrates; was second[2] in copper, magnesium metal, and potash; third in magnesium compounds and mercury; fourth in molybdenum and phosphate rock; fifth in bentonite, gold, crude perlite, silver, and grade-A helium; and sixth in salt. Utah remained the second largest copper-producing State but declined from third to fifth place in gold.

The Utah Geological Survey[3] (UGS) provided the narrative information that follows. Base-metal production, valued at $688 million, was the largest contributor to the value of minerals produced in 1998. In descending order of value, those metals are copper, magnesium metal, molybdenum, beryllium, and vanadium. Precious-metal production, valued at $154 million, included gold (85% of total value) and silver (15% of total value). Kennecott Utah Copper Corp.'s Bingham Canyon Mine in Salt Lake County is the State's sole producer of copper, silver, and molybdenum and is a major producer of gold. The combined value of minerals produced from the Bingham Canyon Mine is more than one-third of the total value of all minerals produced Statewide.

Copper is the largest contributor to the value of nonfuel minerals in the State. Copper prices fell significantly in 1998; the average U.S. producer price, $0.79 per pound, was down from $1.07 per pound in 1997 and was at its lowest level since 1986. Copper production from Kennecott's Bingham Canyon Mine decreased modestly in 1998 to about 280,000 metric tons (t) from 1997 production of about 300,000 t of copper metal. With the completion of their modernization and expansion program, Kennecott's copper production has stabilized at a rate slightly higher than 272,000 t per year.

Magnesium metal was the second largest contributor to the value of base metals in 1998. Magnesium metal is produced from Great Salt Lake brines by Magnesium Corp. of America at its electrolytic plant at Rowley in Tooele County. The plant has a capacity to produce 40,000 t of magnesium metal (99.9% purity) annually and is one of only two active primary processing facilities in the United States. Magnesium production was near capacity in 1998, although demand has decreased worldwide. Domestic producer prices were at their lowest level since 1994.

The sole molybdenum producer in Utah is Kennecott's Bingham Canyon Mine, which produced about 9,100 t of molybdenum concentrate (MoS_2) in 1998, a significant decrease from the nearly 18,000 t produced in 1997. The Bingham Canyon Mine was 1 of 11 molybdenum producers in the United States in 1998. Molybdenum is recovered as a byproduct from the copper milling operation.

Utah continued to be the Nation's leading producer of beryllium metal. Beryllium ore (bertrandite) is mined at Brush Wellman, Inc.'s Topaz and Hogs Back Mines in Juab County and processed with imported beryl at the company's plant a few kilometers north of Delta in Millard County. The Hogs Back Mine began producing in 1998. In 1998, more than 154,000 t of ore was mined and trucked to the company's Delta plant for processing. The product (beryllium hydroxide) is then sent to the company-owned refinery and finishing plant in Ohio where it is converted into beryllium metal, alloys, and oxide. The demand for beryllium alloys and beryllium oxide has increased modestly over the past several years as alloys are being introduced into components for the automobile and electronics industries. Beryllium production in 1998 was the highest that it has been in the past several years.

International Uranium Corp. (IUC) mined a small amount of vanadium ore from the Rim Mine in San Juan County. The ore was shipped to IUC's White Mesa mill near Blanding for processing. The mine had been on standby for several years. Vanadium production is expected to increase at the Rim Mine,

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[1]The terms "nonfuel mineral production" and related "values" encompass variations in meaning, depending on the minerals or mineral products. Production may be measured by mine shipments, mineral commodity sales, or marketable production (including consumption by producers) as is applicable to the individual mineral commodity.

All 1998 USGS mineral production data published in this chapter are preliminary estimates as of February 1999 and are expected to change. For some mineral commodities (for example, construction sand and gravel, crushed stone, and portland cement), estimates are updated periodically. To obtain the most current information, please contact the appropriate USGS mineral commodity specialist. A telephone listing for the specialists may be retrieved over the Internet at http://minerals.usgs.gov/minerals/contacts/comdir.html; by using MINES FaxBack at (703) 648-4999 from a fax machine with a touch-tone handset (request Document #1000 for a telephone listing of all mineral commodity specialists); or by calling USGS information at (703) 648-4000 for the specialist's name and number. All Mineral Industry Surveys—mineral commodity, State, and country—also may be retrieved over the Internet at http://minerals.usgs.gov/minerals; fascimile copies may be obtained from MINES FaxBack.

[2]Values, percentage calculations, and rankings for 1997 may vary from the *Minerals Yearbook, Area Reports: Domestic 1997, Volume II*, owing to the revision of preliminary 1997 to final 1997 data. Data for 1998 are preliminary and expected to change, while related rankings may also be subject to change.

[3]Robert Gloyn, a Senior Geologist with the Utah Geological Survey, authored the text of State minerals information provided by that agency.

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and several new vanadium mines are planning to begin operations in 1999. Vanadium prices reached their highest level in the past 5 years in early 1998 before declining significantly by yearend. This spike in price led to a resurgence of new Small Mine permits but to almost no increase in ore production.

Gold production in 1998 is estimated to be more than 12,400 kilograms (kg), a significant decrease from the record high of nearly 24,900 kg produced in 1997. Gold is produced from two surface mines owned by Kennecott Corp.: one primary producer (Barneys Canyon Mine) and one byproduct operation (Bingham Canyon Mine), both in Salt Lake County. Several small mines in the State are known to produce minor amounts of precious metals, but metal-specific production is not reported and not included in the above totals.

In 1998, silver production statewide was estimated at about 120,000 kg, about 24,900 kg less than 1997. Silver was produced as a byproduct metal from the Bingham Canyon Mine.

The industrial minerals segment, valued at $543 million, was the second largest contributor to the value of minerals produced in 1998. Major mineral commodities produced, by group or individual commodity in descending order of value, included (1) salines, including sulfate of potash, salt, potash (KCl), and magnesium chloride, (2) sand and gravel, and crushed stone, (3) portland cement, lime, limestone, and dolomite, (4) phosphate, (5) gilsonite, (6) gypsum, (7) common clay and bentonite, and (8) expanded shale.

Brine-derived products including salt are the largest contributors to the value of industrial mineral production in Utah. In addition to salt, other brine-derived products include magnesium chloride and potash [potassium chloride and sulfate of potash (SOP)]. The production of salt and other brine-derived products statewide is estimated to be 2.4 million metric tons (Mt) in 1998, the same as 1997.

Salt production alone is estimated to be 1.5 Mt in 1998, with most of the production coming from three operators using brine from Great Salt Lake. These operators are, in descending order of production, (1) IMC Kalium Ogden, Inc. (formerly GSL Minerals), (2) Morton Salt Co., and (3) Cargill Salt Co. (formerly Akzo Nobel Salt). In addition, three other companies produce salt and/or potash from operations not related to Great Salt Lake: (1) Reilly Chemical Co. at Wendover in Tooele County (potash), (2) Moab Salt Co. near Moab in Grand County (salt and potash), and (3) Redmond Minerals, Inc. near Redmond in Sanpete County (salt only).

Potash (KCl and SOP) is produced by three companies: IMC Kalium Ogden, Inc., Reilly Chemical Co., and Moab Salt Co. at their above-mentioned facilities. Potash production is estimated to be more than 390,000 t in 1998 and about 82,000 t less than 1997.

Sand and gravel and crushed stone (including limestone and dolomite) are the second highest value industrial minerals produced in 1998. These materials are produced in every county in Utah by commercial operators and by State, Federal, and county agencies. Because of the large number and diversity of producers, operators are not sent UGS production questionnaires. However, data are compiled by the USGS. The latest production data show that in 1998, 40.7 Mt of sand and gravel and 11.8 Mt of crushed stone were produced with a combined value of $179.3 million. Because of increased highway construction, airport runway construction, and rapid population growth, usage should remain relatively high for the next several years.

Portland cement and lime were respectively the third and fourth highest value industrial minerals produced in 1998. Two operators produce portland cement in Utah: Holnam, Inc. and Ash Grove Cement Co. Holnam's Devil's Slide plant is east of Morgan in Morgan County, and Ash Grove's Leamington plant is east of Lynndyl in Juab County. Both companies have recently expanded production capacity, and the two plants have a combined capacity of more than 1.4 Mt of cement annually, up from 900,000 t in 1997. Both plants operated at or near capacity in 1998.

Lime demand and production remained strong in 1998. Continental Lime Co., which produces high-calcium lime, and Chemical Lime of Arizona, Inc., which produces dolomitic lime, are the two suppliers of calcined limestone (quick lime) and hydrated lime in Utah, with a combined capacity of more than 900,000 t per year. Both operations serve markets in Utah and surrounding States. Continental Lime's plant is in the Cricket Mountains, approximately 56 kilometers (km) southwest of Delta in Millard County, which is rated as one of the 10 largest lime plants in the United States. Chemical Lime of Arizona's plant is near Grantsville in Tooele County.

Nine companies quarried 2.2 Mt of limestone and dolomite in 1998, which was used mainly in the construction industry (1.9 Mt). Approximately 270,000 t was used in steelmaking and for flue gas desulfurization in powerplants. The three largest suppliers of crushed aggregate used in construction are Valley Asphalt Co. from two quarries in Utah County, Larsen Limestone Co. from one quarry in Utah County, and Harper Construction Co. from one quarry in Salt Lake County. A small amount of limestone and dolomite was also crushed to a fine powder and marketed as "rock dust" to the coal mining industry.

Utah's only phosphate operation, SF Phosphate Ltd.'s Vernal Phosphate Operation, is 18 km north of Vernal in Uintah County. SF Phosphates is a partnership of Farmland Industries, Inc. (Missouri) and J.R. Simplot, Inc. (Idaho). The company mines roughly 2.3 Mt per year of ore, which is processed into about 900,000 t of concentrate and is transported in slurry form to the company's Rock Springs, WY, fertilizer plant via a 144-km-long underground pipeline. During 1998, the mine produced more than 2.7 Mt of ore, the highest production level in the past 7 years.

Gilsonite production[4] for 1998 is estimated to be 59,000 t, about the same as 1997. Gilsonite is an unusual solid hydrocarbon that has been mined in Utah for more than 100 years. The three operations that produce gilsonite are all near the town of Bonanza in eastern Uintah County. In descending order of production, they are (1) American Gilsonite Co.'s Bonanza Mine, (2) Zeigler Chemical and Minerals Co.'s Zeigler and Tom Taylor Mines, and (3) Lexco, Inc.'s Cottonwood Mine. Gilsonite is used in more than 150 products ranging from printing inks to explosives and is marketed worldwide. Gilsonite production has been relatively stable for the past several years.

More than 363,000 t of gypsum was produced by six companies in 1998, slightly more than in 1997. In descending order of production, the companies are (1) Georgia Pacific

[4]Shown as asphaltite on map.

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Corp., (2) U.S. Gypsum Co., (3) Thomas J. Peck and Sons, (4) H.E. Davis and Sons, (5) D.K. Gypsum Industries, and (6) Western Clay Co. Both U.S. Gypsum and Georgia Pacific operate wallboard plants near Sigurd in Sevier County. The majority of gypsum produced in Utah is used for making wallboard, but several operators supply raw gypsum to regional cement companies where it is used as an additive to retard the setting time of cement and to the agriculture industry for use as a soil conditioner.

More than 204,000 t of common clay and more than 64,000 t of bentonite were produced by five companies in 1998, a moderate increase in common clay production and a significant increase in bentonite production compared to 1997. In descending order of production, the companies are (1) Interstate Brick Co. (common clay), (2) Redmond Minerals, Inc. (bentonite), (3) Paradise Management Co. (common clay), (4) Western Clay Co. (bentonite), and (5) Interpace Industries, Inc. (common clay). More than 75% of all clay is used in the manufacture of brick. Bentonite is used as a sealant in many civil engineering applications, as a pet waste absorbent (litter box filler), as an additive in oil and gas drilling fluids, and as a binder in foundry molds.

One company, Utelite, Inc., mined about 163,000 t of shale to manufacture "expanded shale" for use as a lightweight aggregate for the construction industry. The mine is near the town of Wanship in Summit County. Production of "expanded shale" products has increased moderately over the past several years. Two other companies (Holnam and Ash Grove Cement) mine modest amounts of shale for use in the manufacture of cement.

Mineral exploration activity remained at a low level in 1998. Twenty-two Notices of Intent (NOI) to explore on public lands were filed with the Utah Division of Oil, Gas, and Mining in 1998, compared to 34 in 1997. Fourteen permits were issued for base metal and/or precious-metals exploration, seven permits were issued that targeted industrial minerals, and one permit was issued for a water well. Most exploration was concentrated in or around several well-known areas and mining districts, and most drilling was done to define reserves at known mines or as followup drilling to further test areas that had been previously drilled. There was very little grass roots exploration or new target generation.

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TABLE 1
NONFUEL RAW MINERAL PRODUCTION IN UTAH 1/ 2/

(Thousand metric tons and thousand dollars unless otherwise specified)

Mineral		1996 Quantity	1996 Value	1997 r/ Quantity	1997 r/ Value	1998 p/ Quantity	1998 p/ Value
Beryllium concentrates	metric tons	5,260	6	5,760	6	5,750	6
Clays:							
Bentonite		W	1,400	W	W	W	W
Common		298	4,510	299	4,510	304	4,600
Fuller's earth		W	32	W	W	--	--
Gemstones		NA	1,150	NA	974	NA	949
Salt		1,720	70,400	1,670	69,000	2,130	65,600
Sand and gravel: Construction		24,700	80,500	33,200	99,400	40,700	125,000
Stone: Crushed		4,380	19,100	11,100	50,200	11,800	54,300
Combined values of cement [masonry (1996), portland], copper, gold, gypsum (crude), helium (Grade-A), lime, magnesium compounds, magnesium metal, mercury, molybdenum, perlite (crude), phosphate rock, potash, silver, stone [dimension quartzite and sandstone (1996)], and values indicated by symbol W		XX	1,570,000 r/	XX	1,450,000	XX	1,050,000
Total		XX	1,740,000 r/	XX	1,680,000	XX	1,300,000

p/ Preliminary. r/ Revised. NA Not available. W Withheld to avoid disclosing company proprietary data; value included with "Combined values" data. XX Not applicable.

1/ Production as measured by mine shipments, sales, or marketable production (including consumption by producers).

2/ Data are rounded to three significant digits; may not add to totals shown.

TABLE 2
UTAH: CRUSHED STONE SOLD OR USED, BY KIND 1/

Kind	1996 Number of quarries	1996 Quantity (thousand metric tons)	1996 Value (thousands)	1996 Unit value	1997 Number of quarries	1997 Quantity (thousand metric tons)	1997 Value (thousands)	1997 Unit value
Limestone 2/	11 r/	1,320 r/	$6,870 r/	$5.22 r/	14	2,500	$14,500	$5.80
Dolomite	5 r/	2,710 r/	10,400 r/	3.83 r/	4	3,790	13,800	3.65
Sandstone	1 r/	W	W	5.88 r/	1	W	W	6.05
Granite	1	W	W	3.67 r/	1	W	W	3.76
Quartzite	1	W	W	10.00 r/	1	W	W	10.14
Volcanic cinder and scoria	1	W	W	11.78 r/	3	80	591	7.39
Miscellaneous stone	--	--	--	--	1	3,790	16,900	4.46
Total	XX	4,380	19,100	4.35	XX	11,100	50,200	4.51

r/ Revised. W Withheld to avoid disclosing company proprietary data; included in "Total." XX Not applicable.

1/ Data are rounded to three significant digits, except unit value; may not add to totals shown.

2/ Includes "limestone-dolomite" reported with no distinction between the two.

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TABLE 3

UTAH: CRUSHED STONE SOLD OR USED

BY PRODUCERS IN 1997, BY USE 1/ 2/

Use	Quantity (thousand metric tons)	Value (thousands)	Unit value
Coarse aggregate (+ 1 1/2 inch):			
Riprap and jetty stone	29	$451	$15.55
Filter stone	W	W	2.20
Coarse aggregate, graded: Concrete aggregate, coarse	W	W	3.31
Fine aggregate (-3/8 inch):			
Stone sand, bituminous mix or seal	W	W	4.41
Screening, undesignated	W	W	3.86
Coarse and fine aggregates:			
Graded road base or subbase	78	225	2.88
Unpaved road surfacing	2	8	4.00
Agricultural:			
Agricultural limestone	W	W	3.43
Poultry grit and mineral food	W	W	24.04
Chemical and metallurgical:			
Cement manufacture	W	W	6.65
Lime manufacture	1,260	5,930	4.72
Flux stone	W	W	11.24
Sulfur oxide removal	W	W	6.18
Special: Mine dusting or acid water treatment	W	W	22.88
Unspecified: 3/			
Actual	7,090	27,100	3.82
Estimated	823	3,310	4.03
Total	11,100	50,200	4.51

W Withheld to avoid disclosing company proprietary data; included in "Total."

1/ Data are rounded to three significant digits, except unit value; may not add to totals shown.

2/ Includes dolomite, granite, limestone, limestone-dolomite, miscellaneous stone, quartzite, sandstone, and volcanic cinder and scoria.

3/ Includes reported and estimated production without a breakdown by end use.

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TABLE 4
UTAH: CRUSHED STONE SOLD OR USED BY PRODUCERS IN 1997, BY USE AND DISTRICT 1/

(Thousand metric tons and thousand dollars)

Use	District 1		District 2		District 3		Unspecified districts	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
Construction aggregates:								
Coarse aggregate (+1 1/2 inch) 2/	--	--	W	W	3	(3/)	--	--
Coarse aggregate, graded 4/	--	--	W	W	--	--	--	--
Fine aggregate (-3/8 inch) 5/	--	--	W	W	--	--	--	--
Coarse and fine aggregate 6/	--	--	W	W	6	(3/)	--	--
Other construction materials	--	--	212	1,040	--	--	--	--
Agricultural 7/	(3/)	(3/)	(3/)	(3/)	--	--	--	--
Chemical and metallurgical 8/	2,340	13,400	(3/)	(3/)	31	(3/)	--	--
Special 9/	--	--	(3/)	(3/)	--	--	--	--
Unspecified: 10/								
Actual	(3/)	(3/)	(3/)	(3/)	29	(3/)	3,790	16,900
Estimated	823	3,310	--	--	--	--	--	--
Total	3,250	17,100	4,020	15,600	69	511	3,790	16,900

W Withheld to avoid disclosing company proprietary data; included with "Other construction materials."
1/ Data are rounded to three significant digits; may not add to totals shown.
2/ Includes filter stone, and riprap and jetty stone.
3/ Withheld to avoid disclosing company proprietary data; included in "Total."
4/ Includes concrete aggregate (coarse).
5/ Includes stone sand (bituminous mix or seal) and screening (undesignated).
6/ Includes graded road base or subbase, unpaved road surfacing.
7/ Includes agricultural limestone and poultry grit and mineral food.
8/ Includes cement manufacture, flux stone, lime manufacture, and sulfur oxide removal.
9/ Includes mine dusting or acid water treatment.
10/ Includes reported and estimated production without a breakdown by end use.

TABLE 5
UTAH: CONSTRUCTION SAND AND GRAVEL SOLD OR USED IN 1997,
BY MAJOR USE CATEGORY 1/

Use	Quantity (thousand metric tons)	Value (thousands)	Value per ton
Concrete aggregate (including concrete sand)	3,510	$13,800	$3.93
Plaster and gunite sands	24	169	7.04
Asphaltic concrete aggregates and other bituminous mixtures	1,160	4,970	4.28
Road base and coverings 2/	3,810	12,300	3.23
Fill	5,130	6,760	1.32
Snow and ice control	39	67	1.72
Other miscellaneous uses	60	236	3.93
Unspecified: 3/			
Actual	9,080	29,800	3.28
Estimated	10,400	31,200	3.01
Total or average	33,200	99,400	2.99

1/ Data are rounded to three significant digits; may not add to totals shown.
2/ Includes road and other stabilization (cement).
3/ Includes reported and estimated production without a breakdown by end use.

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TABLE 6

UTAH: CONSTRUCTION SAND AND GRAVEL SOLD OR USED IN 1997,
BY USE AND DISTRICT 1/

(Thousand metric tons and thousand dollars)

Use	District 1		District 2	
	Quantity	Value	Quantity	Value
Concrete aggregates 2/	1,180	5,430	2,200	7,720
Asphaltic concrete aggregates and other bituminous mixtures	578	2,660	268	734
Road base and coverings 3/	1,730	4,670	767	3,110
Other miscellaneous uses 4/	280	353	4,640	6,260
Unspecified: 5/				
Actual	1,550	5,580	6,320	20,000
Estimated	212	908	9,450	26,100
Total	5,530	19,600	23,600	64,000
	District 3		Unspecified districts	
	Quantity	Value	Quantity	Value
Concrete aggregates 2/	164	831	--	--
Asphaltic concrete aggregates and other bituminous mixtures	215	1,150	101	422
Road base and coverings 3/	867	3,160	443	1,390
Other miscellaneous uses 4/	308	453	--	--
Unspecified: 5/				
Actual	813	3,050	401	1,160
Estimated	721	4,180	--	--
Total	3,090	12,800	945	2,960

1/ Data are rounded to three significant digits; may not add to totals shown.
2/ Includes plaster and gunite sands.
3/ Includes road and other stabilization (cement).
4/ Includes fill, and snow and ice control.
5/ Includes reported and estimated production without a breakdown by end use.

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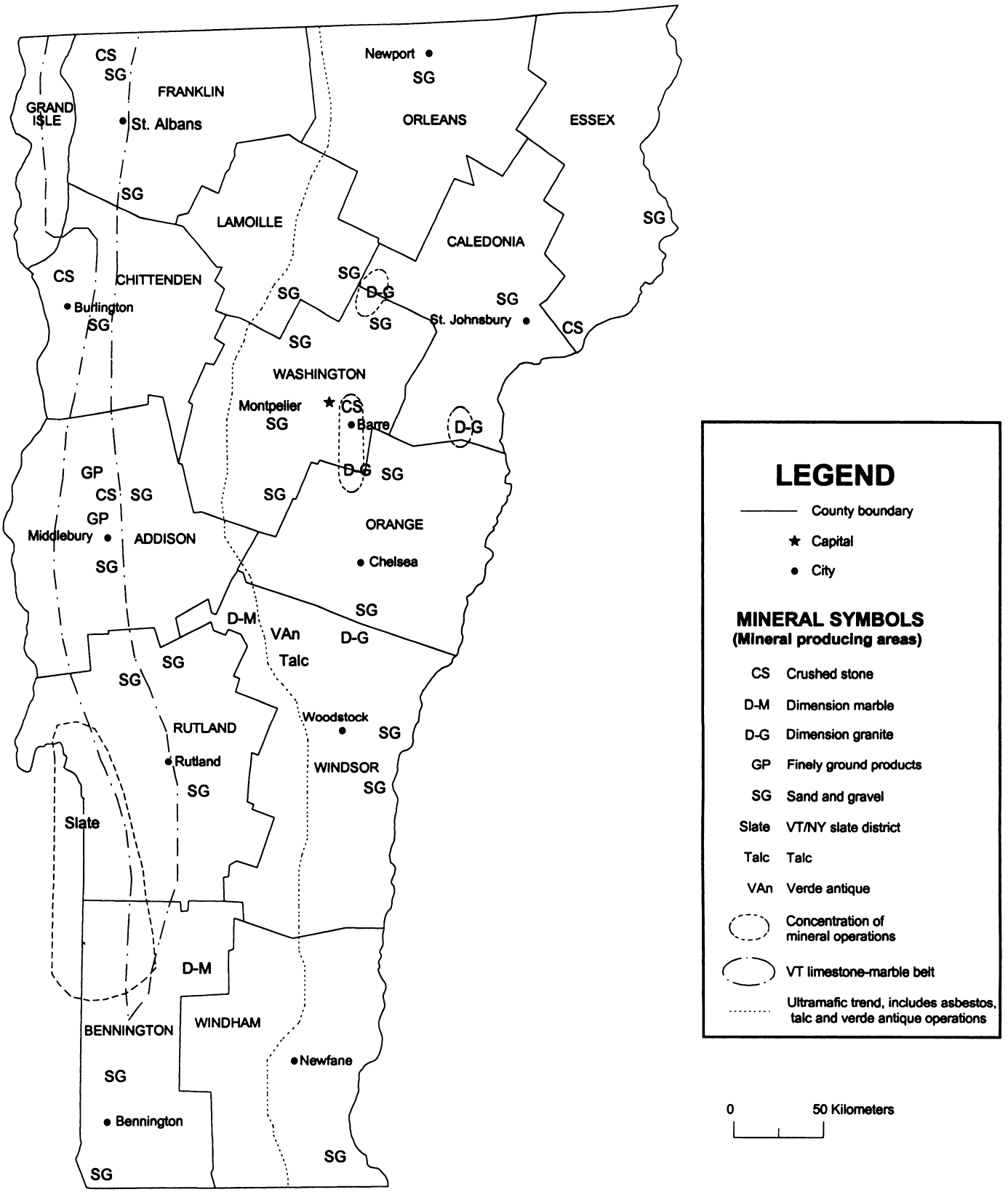
VERMONT



LEGEND

- County boundary
- ★ Capital
- ● City

MINERAL SYMBOLS
(Mineral producing areas)

CS	Crushed stone
D-M	Dimension marble
D-G	Dimension granite
GP	Finely ground products
SG	Sand and gravel
Slate	VT/NY slate district
Talc	Talc
VAn	Verde antique
	Concentration of mineral operations
	VT limestone-marble belt
.....	Ultramafic trend, includes asbestos, talc and verde antique operations

0 50 Kilometers

Source: Vermont Geological Survey, Office of the State Geologist/U.S. Geological Survey (1998)

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THE MINERAL INDUSTRY OF VERMONT

This chapter has been prepared under a Memorandum of Understanding between the U.S. Geological Survey and the Vermont Geological Survey for collecting information on all nonfuel minerals.

In 1998, the preliminary estimated value[1] of nonfuel mineral production for Vermont was $96 million, according to the U.S. Geological Survey (USGS). This was almost a 15% increase from that of 1997,[2] following an even larger 26.5% increase from 1996 to 1997.

Crushed stone, Vermont's leading nonfuel mineral commodity, lead the State's other nonfuel minerals with a $6 million increase in value in 1998 (table 1). Dimension stone and construction sand and gravel followed with increases of more than $4 million and more than $2 million, respectively. Talc and gemstones (listings are by descending order of value) remained unchanged. In 1997, crushed stone also led the State's rise in value with an increase of $21.7 million, followed by successively smaller increases in talc and construction sand and gravel. In 1997, only dimension stone showed a drop in value, although a greater quantity was produced in 1997 than in 1996; gemstones remained unchanged from 1996.

Compared with USGS estimates of the quantities produced in the United States during 1998, Vermont remained second[2] among the States that produced dimension stone and third among those producing talc.

The Vermont Geological Survey (VGS) provided the following narrative information.[3] Rock of Ages Corp., which actively quarries 13 dimension stone sites throughout the United States and Canada, resumed operations on March 4 at its Barre and Bethel locations. The company's two quarries in Barre were active throughout the normal working season in1998. This included the E.L. Smith Quarry which produces Medium to Light Barre Gray granite and the Adam Quarry which produces Dark Barre Gray granite. Planned production levels were met for the year and the quarries closed for the winter on December 18. The Bethel quarry also operated during the same time period in 1998 and planned production levels were met at this location as well. Bethel White granite was chosen for the exterior of the "Little America Grand Hotel" in Salt Lake City. The hotel will host officials and dignitaries from throughout the world for the 2002 Winter Olympics. Approximately 1,400 cubic meters of blocks were used for this one project, making it the largest use ever for Bethel White for an individual building in the quarry's modern day history.

Barre Granite Quarries LLC filed an Act 250 (Vermont's Land Use and Development Law) application for a proposed granite quarry in Sheffield. The application received preliminary comments from the Vermont Agency of Natural Resources in December, but an Act 250 permit had not yet been issued at yearend.

OMYA, Inc. received Act 250 permits in October and November 1997 for expansion of the Middlebury Quarry. The plans included relocation and construction of an access road as well as expansion of the quarry to the south.

According to US Quarried Slate Products, Vermont colored slates are in demand for use as high-quality roofing products. However, the low tariff for most foreign competitors has allowed importation of a lower-price (as well as lower quality) flooring tile, thus reducing the demand for Vermont flooring products.

Government Actions and Programs

The VGS, in cooperation with the USGS Eastern Mineral Resources Program, completed an update of Vermont's mineral resource-data. The VGS contracted with F.M. Beck Inc. of Yarmouth, ME, to review the 700 Vermont listings in the USGS Mineral Resources Data System (or, MRDS) for accuracy and to make corrections and additions where necessary. The new data base contains 729 records of metallic and nonmetallic mineral deposits. One hundred and ninety-two new records were added to the data base and 138 records were amended. About 75 of the additions were small quarries registered under Act 30. (Act 30 established a slate quarry registration program whereby quarries which are properly registered are deemed to be active (not abandoned) and yet exempt from certain requirements of the Act 250 law: in particular for enumerated "ancillary activities," i.e., "drilling, crushing, grinding, sizing, washing, drying, sawing and cutting stone, blasting, trimming, punching, splitting and gauging, and use of buildings and the use and construction of equipment exclusively to carry out the above activities".) The updated assessment will be used in a planning process that focuses on how the VGS can best serve the citizens of the State in regards to mineral-resource issues.

The VGS, also known as the Division of Geology and Mineral Resources in Vermont's Department of Environmental Conservation, conducts surveys and research of the geology, mineral resources, and topography of the State.

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[1]The terms "nonfuel mineral production" and related "values" encompass variations in meaning, depending on the minerals or mineral products. Production may be measured by mine shipments, mineral commodity sales, or marketable production (including consumption by producers) as is applicable to the individual mineral commodity.

All 1998 USGS mineral production data published in this chapter are preliminary estimates as of February 1999 and are expected to change. Construction sand and gravel and crushed stone estimates are updated periodically. To obtain the most current information, please contact the appropriate USGS mineral commodity specialist. A telephone listing for the specialists may be retrieved over the Internet at http://minerals.usgs.gov/minerals/contacts/comdir.html; by using MINES FaxBack at (703) 648-4999 from a fax machine with a touch-tone handset (request Document #1000 for a telephone listing of all mineral commodity specialists); or by calling USGS information at (703) 648-4000 for the specialist's name and number. All Mineral Industry Surveys—mineral commodity, State, and country—also may be retrieved over the Internet at http://minerals.usgs.gov/minerals; facsimile copies may be obtained from MINES FaxBack.

[2]Values, percentage calculations, and rankings for 1997 may vary from the *Minerals Yearbook, Area Reports: Domestic 1997, Volume II*, owing to the revision of preliminary 1997 to final 1997 data. Data for 1998 are preliminary and expected to change, while related rankings may also be subject to change.

[3]Marjorie Gale, a Geologist with the Vermont Geological Survey, authored the State's minerals industry information.

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Of late, emphasis has been on preparation of a bedrock map of Vermont and interim digital map products. A surficial mapping program began in 1996. The State Geologist manages interdisciplinary studies with strong geologic components, especially those focused on surface waters and groundwater resources. Review of projects as they relate to Criteria 9D and 9E of the aforementioned Act 250 is a VGS activity that recognizes the importance of lands with high potential for extraction of mineral and earth resources. The VGS also reviews and makes recommendations regarding mine and quarry reclamation plans in response to current environmental concerns. Published reports are prepared and made available to the public, consultants, industry, and government. The VGS collates and disseminates this practical knowledge in packages ready for the consumer, providing geologic aid and advice to the public as required by State statute.

The VGS also provides advice concerning the development and working of rock and mineral deposits suitable for building, road making, and economic purposes. The VGS maintains an archive of old and new information as per State statute. In the event of any significant discovery of hydrocarbons in the State, the VGS provides geologic services for Vermont's Natural Gas and Oil Resources Board.

Mine Reclamation and Environmental Activities

Significant mine reclamation activity took place in 1998 in the talc industry. A mine and mill reclamation project, begun in 1994, was successfully accomplished at the old talc Mill in Johnson, Lamoille County. Old Mill Park, established on the site of the mill, the old tailings, and the tailings pond, was a cooperative project between Luzenac America, Inc. and the Town of Johnson. The park, dedicated on July 4, has three ball fields, two soccer fields, and a playground.

Luzenac America in Ludlow moved ahead with plans to reclaim and backfill the Blackbear Mine site. The site reclamation plan was previously outlined in the long-range plan for Luzenac's Argonaut Mine. Although initially the plan was to backfill the Blackbear Mine in 2010, the company accelerated the schedule and plans to transfer overburden material from the Argonaut Mine to the site beginning in the spring of 1999.

In December, Champlain Marble Co., the owners of the Fisk Quarry on Isle LaMotte at the northern end of Lake Champlain, proposed to sell their land to conservation groups for $200,000, a price well below market value. The inactive quarry was the source of world famous "Radio City Black" marble. During recent years, the quarry has provided habitat for birds, animals, and plant life. The rocks in Fisk Quarry, part of the Chazy Reef system, have abundant, well-exposed, easily accessible fossils that scientists and schoolchildren have studied for decades. In 1995, the company had purchased the quarry and proposed to reopen mining operations. This did not take place, in part due to the efforts of citizens who have been working to preserve the Fisk Quarry for over 10 years. Upon completion of the sales transaction the quarry will be owned by a newly formed nonprofit organization called the Isle La Motte Reefs Preservation Trust, with a conservation easement held by the Lake Champlain Land Trust to assure the quarry's preservation in perpetuity for scientific research and education. A board of directors was being formed, as well as a science advisory committee, which will help to develop a policy of responsible stewardship.

TABLE 1
NONFUEL RAW MINERAL PRODUCTION IN VERMONT 1/ 2/

(Thousand metric tons and thousand dollars unless otherwise specified)

Mineral		1996		1997 r/		1998 p/	
		Quantity	Value	Quantity	Value	Quantity	Value
Gemstones		NA	1	NA	1	NA	1
Sand and gravel: Construction		3,870	15,200	3,890	15,800	4,300	18,000
Stone:							
Crushed		4,560	22,800	7,840	44,500	8,400	50,400
Dimension	metric tons	99,600	27,900	105,000	23,200	108,000	27,600
Total 3/		XX	66,000	XX	83,500	XX	96,000

p/ Preliminary. r/ Revised. NA Not available. XX Not applicable.
1/ Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
2/ Data are rounded to three significant digits; may not add to totals shown.
3/ Partial total, excludes values that must be concealed to avoid disclosing company proprietary data.

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TABLE 2

VERMONT: CRUSHED STONE SOLD OR USED, BY KIND 1/

Kind	1996 Number of quarries	1996 Quantity (thousand metric tons)	1996 Value (thousands)	1996 Unit value	1997 Number of quarries	1997 Quantity (thousand metric tons)	1997 Value (thousands)	1997 Unit value
Limestone	6	2,260	$8,440	$3.74	7	3,400	$11,900	$3.49
Dolomite	2	W	W	9.10 r/	7	W	W	9.19
Marble	3	1,030	4,610	4.46	3	1,490	6,670	4.49
Granite	2	W	W	5.82 r/	2	W	W	6.17
Quartzite	3	1,120	8,600	7.71	3	2,780	24,500	8.81
Slate	1	W	W	10.21 r/	1	W	W	10.33
Total	XX	4,560	22,800	5.01	XX	7,840	44,500	5.67

r/ Revised. W Withheld to avoid disclosing company proprietary data; included in "Total." XX Not applicable.
1/ Data are rounded to three significant digits, except unit value; may not add to totals shown.

TABLE 3

VERMONT: CRUSHED STONE SOLD OR USED BY PRODUCERS IN 1997, BY USE 1/ 2/

Use	Quantity (thousand metric tons)	Value (thousands)	Unit value
Coarse aggregate (+1 1/2 inch): Riprap and jetty stone	W	W	W
Coarse aggregate, graded:			
Concrete aggregate, coarse	132	$1,120	$8.45
Bituminous aggregate, coarse	326	2,250	6.89
Railroad ballast	67	548	8.18
Other graded coarse aggregate	85	846	9.95
Fine aggregate (-3/8 inch):			
Stone sand, concrete	27	206	7.63
Stone sand, bituminous mix or seal	281	1,880	6.67
Screening, undesignated	54	480	8.89
Other fine aggregate	79	566	7.16
Coarse and fine aggregates:			
Graded road base or subbase	87	509	5.85
Unpaved road surfacing	113	633	5.60
Crusher run or fill or waste	75	147	1.96
Drain fields	3	9	3.00
Other coarse and fine aggregates 3/	240	1,960	8.18
Agricultural: Other agricultural uses	W	W	W
Chemical and metallurgical: Lime manufacture	585	2,370	4.05
Unspecified: 4/			
Actual	3,560	22,200	6.26
Estimated	2,110	8,550	4.05
Total	7,840	44,500	5.67

W Withheld to avoid disclosing company proprietary data; included in "Total."
1/ Includes dolomite, granite, limestone, marble, quartzite, and slate.
2/ Data are rounded to three significant digits; may not add to totals shown.
3/ Includes terrazzo and exposed aggregate.
4/ Includes reported and estimated production without a breakdown by end use.

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TABLE 4
VERMONT: CONSTRUCTION SAND AND GRAVEL SOLD OR USED IN 1997,
BY MAJOR USE CATEGORY 1/ 2/

Use	Quantity (thousand metric tons)	Value (thousands)	Value per ton
Concrete aggregate and concrete products	408	$2,750	$6.74
Plaster and gunite sands	6	50	8.33
Asphaltic concrete aggregates and other bituminous mixtures	211	978	4.64
Road base and coverings 3/	1,200	4,860	4.06
Fill	188	445	2.37
Snow and ice control	333	1,180	3.53
Filtration	33	185	5.61
Other miscellaneous uses	236	1,370	5.79
Unspecified: 4/			
Actual	184	661	3.59
Estimated	1,090	3,370	3.09
Total or average	3,890	15,800	4.07

1/ To avoid disclosing company proprietary data, no district tables were produced for 1997.
2/ Data are rounded to three significant digits; may not add to totals shown.
3/ Includes road and other stabilization (cement).
4/ Includes reported and estimated production without a breakdown by end use.

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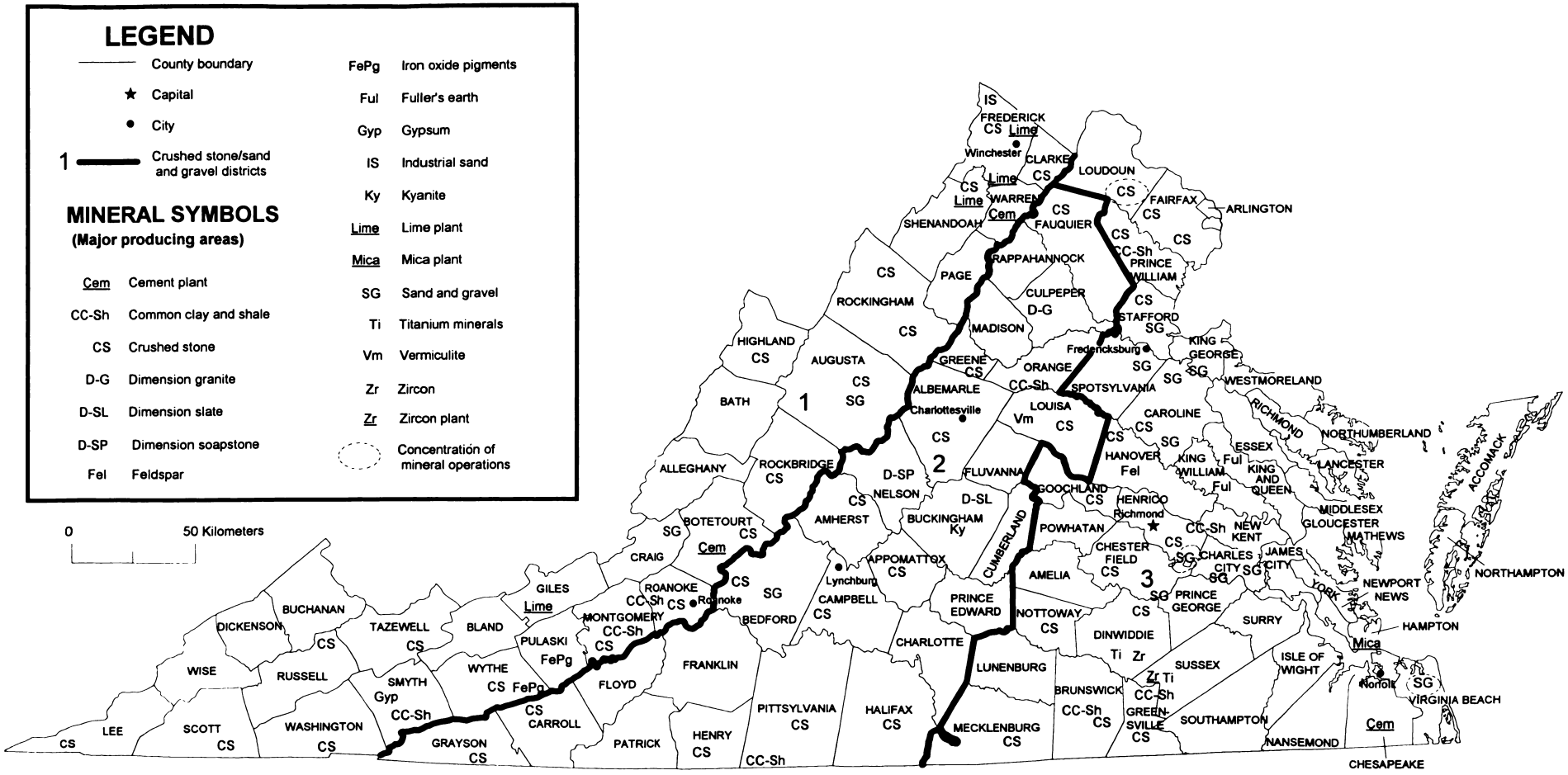
VIRGINIA



Source: Virginia Department of Mines, Minerals and Energy/U.S. Geological Survey (1998)

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THE MINERAL INDUSTRY OF VIRGINIA

This chapter has been prepared under a Memorandum of Understanding between the U.S. Geological Survey and the Virginia Department of Mines, Minerals and Energy for collecting information on all nonfuel minerals.

In 1998, the preliminary estimated value[1] of nonfuel mineral production for Virginia was $679 million, according to the U.S. Geological Survey (USGS). This was almost a 6% increase from that of 1997,[2] and followed a 16.9% increase from 1996 to 1997. For the third consecutive year, Virginia was 22d in rank among the 50 States in total nonfuel mineral production value, of which the State accounted for more than 1.5% of the U.S. total.

Crushed stone was Virginia's leading nonfuel mineral, accounting for 65% of the State's total value (table 1). From 1990 through 1998, Virginia produced more than 510 million metric tons of crushed stone, or an average of almost 57 million metric tons per year. In 1998, the increased values of crushed stone (up $14 million), fuller's earth (up about $12 million), zirconium concentrates, and portland cement accounted for most of the State's increase. All other nonfuel minerals showed relatively small increases except feldspar, crude gypsum, crude iron oxide pigments, dimension stone, and talc, all of which had small decreases, and industrial sand and gravel, which remained unchanged. In 1997, crushed stone with a $77 million increase accounted for the largest portion of the State's increase in value; construction sand and gravel, portland cement, lime, and feldspar (descending order of magnitude of change) also significantly contributed to Virginia's rise in value.

Based on USGS estimates of quantities produced in the 50 States during 1998, Virginia remained the only[2] State to mine kyanite; second of 2 States that produce vermiculite; third in feldspar; fifth of 6 States that produce crude iron oxide pigments; and ninth in lime. With production commencing in 1998, the State was second of two zirconium concentrate-producing States and third of three States that produce titanium mineral concentrate (ilmenite). While Virginia climbed in rank to seventh from ninth in fuller's earth, the State decreased from fifth to sixth in the production of crushed stone. Additionally, significant quantities of masonry cement and common clays were produced in the State. While the only producing kyanite mine and calcined kyanite (mullite) facilities in the United States were in Virginia, synthetic mullite, a calcined bauxite, was synthetically produced in one other State. About 90% of U.S. kyanite and mullite output is used in refractories for the smelting and processing of a variety of metals and in glass and high-temperature ceramics manufacturing.

The following narrative information was provided by the Virginia Division of Mineral Resources[3] (VDMR). RGC (USA) Mineral Sands Inc. continued its titanium mining and initial processing operations in Dinwiddie County and commenced processing of concentrate (ilmenite) near the town of Stony Creek, Sussex County, south of Richmond. Almost 33,000 metric tons of mineral sands were produced during mine development in the last few months of 1997, prior to full production that began in January 1998. Seventy jobs were created as a result of the mining and processing operations, and an additional 25 jobs for hauling, and supply servicing, and contract mining operations. In early 1998, several geologic faults were discovered in the pits, for which the mining procedure was changed to take advantage of higher grade mineralized zones.

Vulcan Materials Co.'s Lowmoor Quarry in Alleghany County was reopened in 1997 and produced almost 12,000 tons of crushed limestone in the latter part of the year. In the western part of the State, the most active markets are for roadstone and asphalt stone. Vulcan Materials also is now working with Chesterfield County on site plans to reopen the old Cashion Quarry, which they operated from 1974-77. The quarry, just southwest of Richmond, is in granitic rock and was scheduled to open in the spring of 1999 to produce roadstone. During the year, W.W. Boxley's Blue Ridge Stone Corp. proposed to open a limestone quarry at a site south of Eagle Rock, in Botetourt County. Toward yearend, the company was in the process of obtaining State permits.

A Division of Ralston Purina Co., Golden Cat, continued producing cat litter at its new (1997) manufacturing plant, about 25 miles northeast of Richmond in King William County. The plant uses fuller's earth from King and Queen County. During the last few months of 1997, clay production from the mine site was more than 11,300 tons.

The former Tulikivi soapstone operation in Schuyler, Nelson County, was purchased by New World Stone Co. in November. The company purchased the 11-hectare complex, including the mill building and a dozen other buildings. The company is in the process of applying for the mineral rights at

[1]The terms "nonfuel mineral production" and related "values" encompass variations in meaning, depending on the minerals or mineral products. Production may be measured by mine shipments, mineral commodity sales, or marketable production (including consumption by producers) as is applicable to the individual mineral commodity.

All 1998 USGS mineral production data published in this chapter are preliminary estimates as of February 1999 and are expected to change. For some mineral commodities (for example, construction sand and gravel, crushed stone, and portland cement), estimates are updated periodically. To obtain the most current information, please contact the appropriate USGS mineral commodity specialist. A telephone listing for the specialists may be retrieved over the Internet at http://minerals.usgs.gov/minerals/contacts/comdir.html; by using MINES FaxBack at (703) 648-4999 from a fax machine with a touch-tone handset (request Document #1000 for a telephone listing of all mineral commodity specialists); or by calling USGS information at (703) 648-4000 for the specialist's name and number. All Mineral Industry Surveys—mineral commodity, State, and country—also may be retrieved over the Internet at http://minerals.usgs.gov/minerals; facsimile copies may be obtained from MINES FaxBack.

[2]Values, percentage calculations, and rankings for 1997 may vary from the *Minerals Yearbook, Area Reports: Domestic 1997, Volume II*, owing to the revision of preliminary 1997 to final 1997 data. Data for 1998 are preliminary and expected to change, while related rankings may also be subject to change.

[3]Palmer Sweet, Head Geologist with the Virginia Division of Mineral Resources, authored the text of mineral industry information submitted by that agency.

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several of the former quarries. Also, plans were being discussed to possibly create an art colony to inspire architects to make soapstone as popular as vinyl siding. Initially, the company will use some of the existing, already mined, soapstone blocks to produce items such as laboratory tops, sills, or sculpture for special orders.

In 1998, several companies conducted reconnaissance geologic, geochemical, and geophysical investigations for base and precious metals in the southwestern Piedmont province of Virginia. Gold Crown Mining Co. continued to permit and intermittently work the old Kentuck Mine, east of Danville, Pittsylvania County, for small amounts of gold. Southern Piedmont Mining continued to permit the old Moss gold mine in Goochland County, although no processing of ore was reported from a permitted site near the Goochland County-Fluvanna County line.

Increasing company interest continued in the Cedar Grove Church and the Linville high-calcium limestone deposits in Rockingham County in the Valley and Ridge province of Virginia. Both deposits contain high-quality New Market Limestone and are close to rail transportation.

Government Activities and Programs

The VDMR continued geologic mapping on several counties at a detailed 1:24,000 scale and continued to map, compile, and digitize 1:100,000 scale maps. The agency also continued to conduct selected field studies to compile a record of mineral resources on 1:24,000 scale maps, to conduct oil and gas studies of Dickenson and Russell Counties, and to prepare a paper regarding mineral resources and comprehensive land use planning. During 1998, reports were published on: the statistics of industrial and metallic mineral resources, coal, oil, and gas produced in the State for 1997; clay deposits in Augusta and Rockbridge Counties; the mining and processing of byproduct resources in Virginia; and a history of brick production in the Albemarle County-City of Charlottesville area. Also published was an article on the geology and history of the Civil War iron industry in the New River-Cripple Creek District of southwestern Virginia.

An ambitious program to digitize all previously published VDMR geologic maps was underway, with nearly 90% of the maps in some stage of completion. Under the supervision of Division geologists, college students, for the most part, were doing the work. In a separate program, plans were being developed to scan all VDMR reports published since 1905. These will be made available as Portable Document Format (PDF) files on CD-ROM. In addition to the convenience of having all of VDMR maps and reports available in digital form, previously out-of-print publications will be made permanently available as a result of the project.

The Geologic Map of Virginia (1:500,000 scale), fully digitized and in the final stages of editing, was being prepared to be issued on CD-ROM as a color raster image accompanied by digital vector data in a variety of standard formats (for example, ARC/INFO, ArcView, and AutoCAD). Additionally, the digital Geologic Map of Virginia was being processed for presentation on the Internet as a set of interactive maps using MapGuide software.

The Mineral Resources of Virginia database, which contains location and identification information on mines, quarries, and prospects, was in the process of being updated as fieldwork is completed. In four counties, pilot projects to develop water-well databases were underway in an effort to establish the relation between bedrock geology and well yields. The Division's oil and gas well database is being expanded to include historical production information.

TABLE 1
NONFUEL RAW MINERAL PRODUCTION IN VIRGINIA 1/ 2/

(Thousand metric tons and thousand dollars unless otherwise specified)

Mineral	1996		1997		1998 p/	
	Quantity	Value	Quantity	Value	Quantity	Value
Clays:						
Common	883	3,220	830	3,160	846	3,220
Fuller's earth	46	W	W	W	W	W
Gemstones	NA	11	NA	W	NA	W
Lime	766	45,700	818	49,300	848	49,500
Sand and gravel: Construction	9,780	45,800	10,700	52,700	10,600	54,000
Stone: Crushed	59,700	351,000	72,800	428,000	73,600	442,000
Combine values of cement, feldspar, gypsum (crude), iron oxide pigments (crude), kyanite, sand and gravel (industrial), stone [dimension dolomite, granite, and slate (1998), dimension dolomite, slate, and traprock (1996-97)], talc and pyrophyllite, titanium concentrates (ilmenite), vermiculite, zirconium concentrates, and values indicated by symbol W	XX	103,000	XX	109,000	XX	131,000
Total	XX	549,000	XX	642,000	XX	679,000

p/ Preliminary. NA Not available. W Withheld to avoid disclosing company proprietary data; value included with "Combined values" data. XX Not applicable.

1/ Production as measured by mine shipments, sales, or marketable production (including consumption by producers).

2/ Data are rounded to three significant digits; may not add to totals shown.

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TABLE 2

VIRGINIA: CRUSHED STONE SOLD OR USED, BY KIND 1/

Kind	1996 Number of quarries	1996 Quantity (thousand metric tons)	1996 Value (thousands)	1996 Unit value	1997 Number of quarries	1997 Quantity (thousand metric tons)	1997 Value (thousands)	1997 Unit value
Limestone 2/	43	16,500	$94,600	$5.73	41	15,700	$93,500	$5.97
Dolomite	12	4,480	30,900	6.91	10	4,880	33,700	6.92
Granite	30	24,000	138,000	5.74	38	38,500	218,000	5.67
Traprock	11	12,500	71,900	5.74	10	11,400	64,100	5.64
Sandstone and quartzite	7	1,190	6,810	5.71	6	1,410	8,460	6.00
Slate	2	W	W	W	2	W	W	W
Miscellaneous stone	2	W	W	W	2	W	W	W
Total	XX	59,700	351,000	5.87	XX	72,800	428,000	5.88

W Withheld to avoid disclosing company proprietary data; included in "Total." XX Not applicable.
1/ Data are rounded to three significant digits, may not add to totals shown.
2/ Includes "limestone-dolomite," reported with no distinction between the two.

TABLE 3

VIRGINIA: CRUSHED STONE SOLD OR USED BY PRODUCERS IN 1997, BY USE 1/ 2/

Use	Quantity (thousand metric tons)	Value (thousands)	Unit value
Coarse aggregate (+1 1/2 inch):			
Macadam	208	$833	$4.00
Riprap and jetty stone	1,220	9,990	8.20
Filter stone	613	4,000	6.52
Other coarse aggregate	365	2,750	7.53
Coarse aggregate, graded:			
Concrete aggregate, coarse	7,690	50,700	6.59
Bituminous aggregate, coarse	4,110	28,300	6.88
Bituminous surface-treatment aggregate	2,960	21,000	7.08
Railroad ballast	689	4,250	6.17
Other graded coarse aggregate	1,550	10,500	6.76
Fine aggregate (-3/8 inch):			
Stone sand, concrete	1,020	7,220	7.09
Stone sand, bituminous mix or seal	690	4,530	6.57
Screening, undesignated	2,260	12,300	5.43
Other fine aggregate	947	5,720	6.04
Coarse and fine aggregates:			
Graded road base or subbase	10,700	57,500	5.39
Unpaved road surfacing	1,370	9,080	6.61
Crusher run or fill or waste	3,980	19,300	4.83
Other coarse and fine aggregates	1,200	6,930	5.75
Other construction materials	136	852	6.26
Agricultural:			
Agricultural limestone	687	5,510	8.02
Poultry grit and mineral food	69	775	11.23
Other agricultural uses	65	769	11.83
Chemical and metallurgical:			
Cement manufacture	W	W	4.30
Lime manufacture	757	6,010	7.94
Glass manufacture	28	240	8.57
Sulfur oxide removal	W	W	6.44
Special:			
Mine dusting or acid water treatment	W	W	7.98
Asphalt fillers or extenders	71	338	4.76
Other fillers or extenders	W	W	10.75
Other miscellaneous uses:			
Lighweight aggregate (slate)	W	W	33.07
Waste material	W	W	2.38
Unspecified: 3/			
Actual	22,500	113,000	5.03
Estimated	5,530	35,400	6.40
Total	72,800	428,000	5.88

W Withheld to avoid disclosing company proprietary data; included in "Total."
1/ Includes dolomite, granite, limestone, miscellaneous stone, sandstone and quartzite, slate, and traprock.
2/ Data are rounded to three significant digits, except unit value; may not add to totals shown.
3/ Includes reported and estimated production without a breakdown by end use.

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TABLE 4
VIRGINIA: CRUSHED STONE SOLD OR USED BY PRODUCERS IN 1997, BY USE AND DISTRICT 1/

(Thousand metric tons and thousand dollars)

Use	District 1		District 2		District 3		Unspecified districts	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
Construction aggregates:								
Coarse aggregate (+1 1/2 inch) 2/	842	4,860	444	3,420	1,130	9,380	--	--
Coarse aggregate, graded 3/	3,970	25,400	3,120	22,400	9,950	67,400	--	--
Fine aggregate (-3/8 inch) 4/	1,670	10,200	841	5,710	2,410	13,900	--	--
Coarse and fine aggregate 5/	4,260	22,200	3,920	25,100	9,250	50,600	--	--
Other construction materials 6/	W	W	W	W	W	W	--	--
Agricultural 7/	630	5,130	W	W	W	W	--	--
Chemical and metallurgical 8/	1,990	11,500	--	--	--	--	--	--
Special 9/	91	527	--	--	--	--	--	--
Unspecified: 10/								
Actual	W	W	W	W	21,300	105,000	(11)	2
Estimated	4,690	30,500	837	4,820	--	--	--	--
Total	18,400	112,000	10,200	69,100	44,200	247,000	(11)	2

W Withheld to avoid disclosing company proprietary data; included in "Total."
1/ Data are rounded to three significant digits; may not add to totals shown.
2/ Includes filter stone, macadam, riprap and jetty stone, and other coarse aggregate.
3/ Includes concrete aggregate (coarse), bituminous aggregate (coarse), bituminous surface-treatment aggregate, railroad ballast, and other graded coarse aggregate.
4/ Includes stone sand (concrete), stone sand (bituminous mix or seal), screening (undesignated), and other fine aggregate.
5/ Includes graded road base or subbase, unpaved road surfacing, crusher run (select material or fill), and other coarse and fine aggregates.
6/ Includes lightweight aggregate (slate) and waste materials.
7/ Includes agricultural limestone, poultry grit and mineral food, and other agricultural uses.
8/ Includes cement manufacture, glass manufacture, lime manufacture, and sulfur oxide removal.
9/ Includes asphalt fillers or extenders, mine dusting or acid water treatment, and other fillers or extenders.
10/ Includes reported and estimated production without a breakdown by end use.
11/ Less than 1/2 unit.

TABLE 5
VIRGINIA: CONSTRUCTION SAND AND GRAVEL SOLD OR USED IN 1997,
BY MAJOR USE CATEGORY 1/

Use	Quantity (thousand metric tons)	Value (thousands)	Value per ton
Concrete aggregate (including concrete sand) 2/	6,100	$34,700	$5.68
Concrete products (blocks, bricks, pipe, decorative, etc.)	248	1,630	6.58
Asphaltic concrete aggregates and other bituminous mixtures	517	2,890	5.58
Road base and coverings 3/	603	1,370	2.26
Fill	1,130	3,010	2.67
Other miscellaneous uses 4/	204	1,020	5.00
Unspecified: 5/			
Actual	1,350	5,870	4.35
Estimated	499	2,180	4.36
Total or average	10,700	52,700	4.94

1/ Data are rounded to three significant digits; may not add to totals shown.
2/ Includes plaster and gunite sands.
3/ Includes road and other stabilization (cement and lime).
4/ Includes snow and ice control.
5/ Includes reported and estimated production without a breakdown by end use.

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TABLE 6
VIRGINIA: CONSTRUCTION SAND AND GRAVEL SOLD OR USED IN 1997,
BY USE AND DISTRICT 1/

(Thousand metric tons and thousand dollars)

Use	District 1		District 2		District 3	
	Quantity	Value	Quantity	Value	Quantity	Value
Concrete aggregates and concrete products 2/	W	W	W	W	5,950	33,300
Asphaltic concrete and road base materials 3/	W	W	W	W	783	2,040
Other miscellaneous uses 4/	W	W	W	W	1,330	4,020
Unspecified 5/	257	1,130	58	371	1,540	6,550
Total	879	5,650	176	1,080	9,600	45,900

W Withheld to avoid disclosing company proprietary data; included in "Total."
1/ Data are rounded to three significant digits; may not add to totals shown.
2/ Includes plaster and gunite sands.
3/ Includes road and other stabilization (cement and lime).
4/ Includes fill, and snow and ice control.
5/ Includes reported and estimated production without a breakdown by end use.

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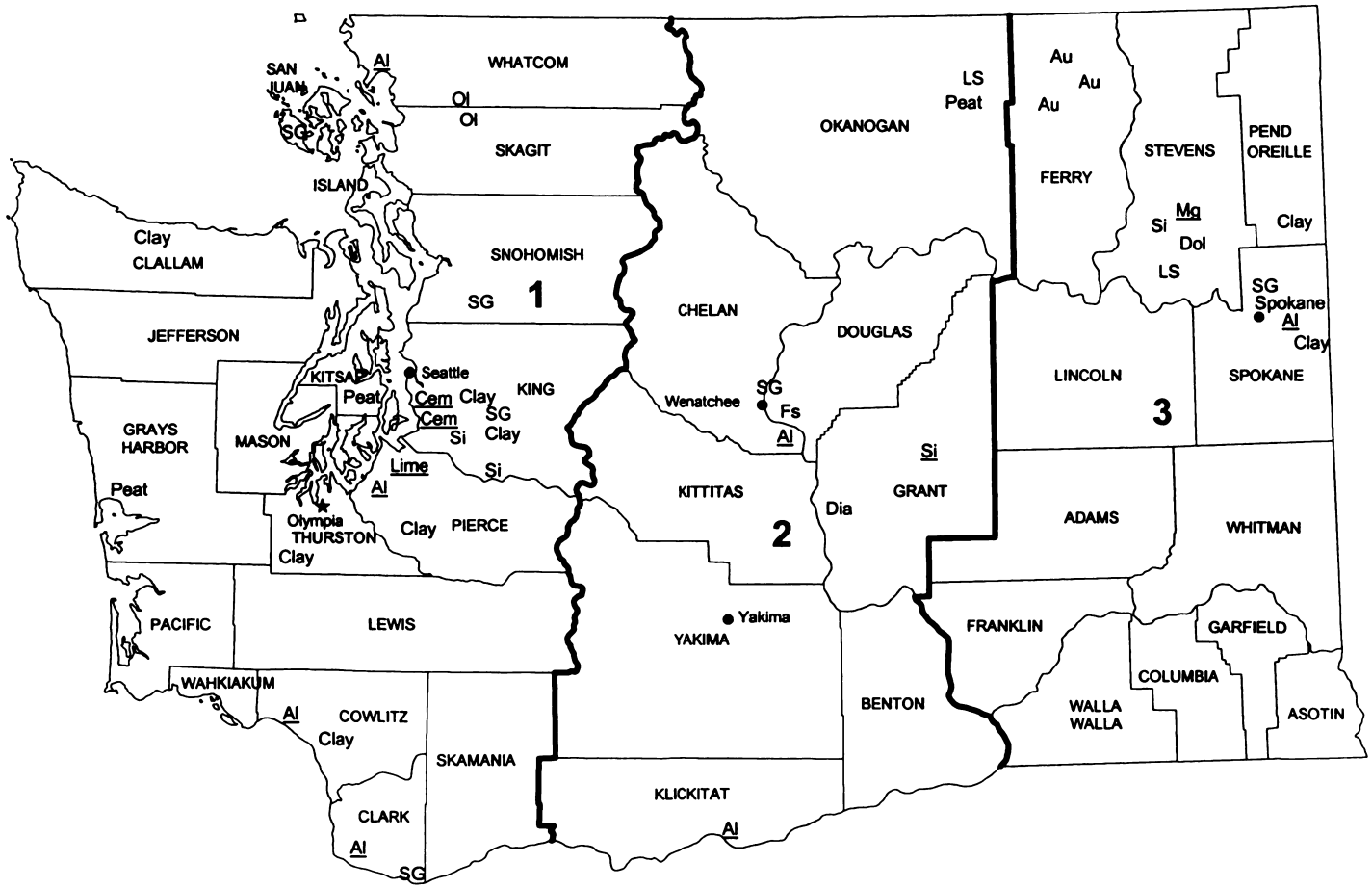
WASHINGTON



LEGEND

- County boundary
- ★ Capital
- ● City
- 1 — Crushed stone/sand and gravel districts

MINERAL SYMBOLS

(Major producing areas)

Al	Aluminum plant
Au	Gold
Cem	Cement plant
Clay	Clay
Dia	Diatomite
Dol	Dolomite
Fs	Ferrosilic
Gyp	Gypsum
Lime	Lime plant
LS	Limestone
Mg	Magnesium metal plant
Ol	Olivine
Pb	Lead
Peat	Peat
Si	Silica
Si	Silica plant
SG	Sand and gravel
Zn	Zinc

0 — 50 Kilometers

Source: Washington State Division of Geology and Earth Resources/U.S. Geological Survey (1998)

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THE MINERAL INDUSTRY OF WASHINGTON

This chapter has been prepared under a Memorandum of Understanding between the U.S. Geological Survey and the Washington State Department of Natural Resources, Division of Geology and Earth Resources, for collecting information on all nonfuel minerals.

In 1998 the preliminary estimated value[1] of nonfuel mineral production for Washington was $583 million, according to the U.S. Geological Survey (USGS). This was a 5% increase from that of 1997,[2] and followed a 1.8% increase from 1996 to 1997. The State dropped in rank to 26th from 24th in the Nation in total nonfuel mineral production, of which Washington accounted for more than 1% of the U.S. total.

Three mineral commodities accounted for about 68% of the State's nonfuel mineral value: construction sand and gravel, portland cement, and crushed stone, in descending order of value. In 1998, Washington's rise in value resulted mainly from a $33 million increase in the value of construction sand and gravel and $5.6 million increases each in portland cement and magnesium metal; these gains were offset some by a combined decrease of $14 million in the values of gold and crushed stone (table 1). The only other decrease included a relatively small drop in the value of industrial sand and gravel and marginal decreases in olivine, dimension stone, and peat (listings are in descending magnitude of change). In 1997, the increased values of construction sand and gravel, portland cement, and crushed stone totaled more than the decreases that occurred in magnesium metal, gold, and lime, resulting in the State's $10 million gain for the year (table 1). All other changes were small and inconsequential to the net result.

Based on USGS estimates of the quantities produced in the 50 States in 1998, Washington remained first[2] of 2 States that produce olivine; third of 3 magnesium metal-producing States; fourth of 4 States that produce diatomite; and ninth in gold. The State dropped from 5th to 6th in construction sand and gravel. In 1998, Washington continued to lead the Nation in the production of primary aluminum with an estimated 1.15 million metric tons, about a 2% increase from that of 1997. The State accounted for nearly 31% of the U.S. total primary aluminum production. Raw steel was also produced in the State, both metals being processed from materials received from foreign and non-Washington State sources.

The Washington State Division of Geology and Earth Resources[3] (DGER) provided the following narrative information. Production data in the text that follows are those reported by the DGER based on the agency's own surveys and estimates. They may differ from some production figures reported to the USGS.

In the metallic mineral industry, the Kettle River Project of Echo Bay Minerals Co. was the only major gold mining operation in Washington in 1998. The company mines ore from the Lamefoot and K-2 gold deposits northeast of Republic in Ferry County. A total of about 734,000 metric tons of ore was processed at the company's mill near Republic, compared with about 771,000 tons in 1997. Total gold recovered in 1998 was 3,660 kilograms, up from the 4,040 kilograms recovered in 1997.

Echo Bay processed about 488,000 tons of ore and recovered 2,200 kilograms of gold from the Lamefoot deposit, an exhalative/replacement-type deposit in Permian rocks. The company processed more than 244,000 tons of ore and recovered 1,300 kilograms of gold from the K-2 deposit, an epithermal vein-type deposit in Eocene volcanic rocks.

At the end of 1998, Echo Bay reported proven and probable ore reserves at Lamefoot of 586,000 tons containing 3,920 kilograms of gold. Proven and probable ore reserves at K-2 are more than 476,000 tons containing 3,450 kilograms of gold. The company continued its extensive exploration drilling program on and near its operating mines and on other properties in the region.

Battle Mountain Gold Co. continued the process of obtaining permits to put the Crown Jewel gold deposit in Okanogan County into production. This process proceeded in earnest following release in 1997 of the Environmental Impact Statement (EIS) for the proposed mine. The company intends to begin construction of the mine and mill after obtaining the necessary permits.

Cominco American Inc. initiated the process of reopening its Pend Oreille zinc/lead mine in northern Pend Oreille County through preparation of an EIS commensurate with rules and regulations in effect in 1998. The anticipated release of the draft EIS was expected sometime in the summer of 1999 with the final EIS to be released sometime late in the year. Cominco announced a reserve at this Mississippi-Valley type zinc-lead deposit of 5.9 million tons with an average grade of 8.9% zinc and 1.6% lead. Cominco is planning to reopen the mine in 2002.

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[1]The terms "nonfuel mineral production" and related "values" encompass variations in meaning, depending on the minerals or mineral products. Production may be measured by mine shipments, mineral commodity sales, or marketable production (including consumption by producers) as is applicable to the individual mineral commodity.

All 1998 USGS mineral production data published in this chapter are preliminary estimates as of February 1999 and are expected to change. For some mineral commodities (for example, construction sand and gravel, crushed stone, and portland cement), estimates are updated periodically. To obtain the most current information, please contact the appropriate USGS mineral commodity specialist. A telephone listing for the specialists may be retrieved over the Internet at http://minerals.usgs.gov/minerals/contacts/comdir.html; by using MINES FaxBack at (703) 648-4999 from a fax machine with a touch-tone handset (request Document #1000 for a telephone listing of all mineral commodity specialists); or by calling USGS information at (703) 648-4000 for the specialist's name and number. All Mineral Industry Surveys—mineral commodity, State, and country—also may be retrieved over the Internet at http://minerals.usgs.gov/minerals; facsimile copies may be obtained from MINES FaxBack.

[2]Values, percentage calculations, and rankings for 1997 may vary from the *Minerals Yearbook, Area Reports: Domestic 1997, Volume II*, owing to the revision of preliminary 1997 to final 1997 data. Data for 1998 are preliminary and expected to change, while related rankings may also be subject to change.

[3]Robert E. Derkey, Geologist, authored the text of mineral industry information submitted by the Washington State Division of Geology and Earth Resources.

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Northwest Alloys Inc. (a subsidiary of Aluminum Co. of America) produces magnesium metal from the dolomite at its plant near Addy in Stevens County. The company mined approximately 544,000 tons of dolomite in 1998 compared with 483,000 tons in 1997. In addition to magnesium metal, Northwest Alloys produced byproduct dolomitic lime.

The DGER reported that there were no known major metallic mineral exploration projects conducted in Washington State in 1998.

In the industrial minerals industry, carbonates, clays, diatomite, olivine, and silica (as well as aggregates) continued to be mined in Washington in 1998. Columbia River Carbonates continued to produce finely ground calcium carbonate of high brightness from the Wauconda quarry in Ferry County that was marketed and used to make acid-free paper. The calcium carbonate is shipped to and processed at its plant in Longview, Cowlitz County.

Several companies mined and sold limestone or dolomite as a soil conditioner and/or as feed lime in 1998. Pacific Calcium Inc. produced more than 10,400 tons of limestone from the Tonasket quarry and 4,840 tons of dolomite from the Brown quarry in Okanogan County. Allied Minerals, Inc. produced 6,350 tons of dolomite from its Gehrke quarry in Stevens County. (As previously stated, Northwest Alloys produced byproduct dolomitic lime at its magnesium metal production plant near Addy, Stevens County.) Northport Limestone Co. mined almost 45,400 tons of limestone from its Sherve quarry in Stevens County and shipped it to Trail, B.C., Canada, where it was used as a fluxing agent in smelting. Northwest Marble Products mined color- and site-specific carbonate products for terrazzo tile and related products.

Olivine Corp. mined approximately 49,900 tons of olivine of the Twin Sisters dunite in 1998 from its Swen Larsen quarry in Whatcom County. As in previous years, the majority of the company's production was shipped as crushed olivine to Unimin Corp., a Belgian company that produces casting sands and other refractory products at Hamilton in Skagit County. The rest of Olivine Corp.'s production was used to produce refractory liners for waste incinerators.

A major ownership change occurred in Washington's cement industry when Holnam Inc. sold its Seattle operations to Lafarge Corp. Larfarge assumed control of the plant in October. During the year, Holnam Inc./Lafarge Corp. mined approximately 74,400 tons of clay from the Twin River quarry in Clallam County. Ash Grove Cement Co. mined 16,600 tons of clay from its Castle Rock quarry in Cowlitz County and nearly 118,000 tons of silica from its Superior quarry in King County. Pacific Coast Coal Co. mined 43,700 tons of clay from the John Henry #1 coal mine and shipped it to Ash Grove Cement Co. in Seattle.

Mutual Materials Co. mined clay in Spokane County at the Mica Mine, in Pend Oreille County at the Usk Mine, in King County at the Elk pit and Section 31 pit, in Pierce County at the Clay City pit, and in Thurston County from the Bucoda pit. Most of its production is used for bricks and related products.

Celite Corp. mined and processed more than 95,300 tons of diatomite at its pits in Grant County, producing more than 65,300 tons of finished diatomite.

Lane Mountain Silica Co. mined more than 272,000 tons of Addy Quartzite from the Lane Mountain quarry in Stevens County. Following processing, the company shipped 209,000 tons of high-purity quartz for manufacturing clear glass bottles and jars. Reserve Silica Corp. mined 63,500 tons of quartz-rich Puget Group sands from the Ravensdale pit in King County. Most of Reserve's production is used for the manufacture of colored bottle glass.

TABLE 1
NONFUEL RAW MINERAL PRODUCTION IN WASHINGTON 1/ 2/

(Thousand metric tons and thousand dollars unless otherwise specified)

Mineral		1996 Quantity	1996 Value	1997 Quantity	1997 Value	1998 p/ Quantity	1998 p/ Value
Cement: Portland		1,160	78,900 e/	1,210	92,400 e/	1,250	98,000
Clays: Common		218	1,070	165	715	168	729
Gemstones		NA	36	NA	23	NA	25
Gold 3/	kilograms	W	W	4,040	43,200	3,660	34,800
Gypsum, crude		W	W	12	549	--	--
Sand and gravel: Construction		37,900	162,000	40,500	180,000	46,500	213,000
Silver 3/	metric tons	--	--	2	285	2	312
Stone: Crushed		15,400	81,400	14,700	92,200	14,400	86,400
Combined values of cement (masonry), diatomite, lime, magnesium metal, olivine, peat, sand and gravel (industrial), stone [dimension miscellaneous), and values indicated by symbol W		XX	221,000 r/	XX	146,000	XX	150,000
Total		XX	545,000 r/	XX	555,000	XX	583,000

e/ Estimated. p/ Preliminary. r/ Revised. NA Not available. W Withheld to avoid disclosing company proprietary data; value included with "Combined values" data. XX Not applicable.

1/ Production as measured by mine shipments, sales, or marketable production (including consumption by producers).

2/ Data are rounded to three significant digits; may not add to totals shown.

3/ Recoverable content of ores, etc.

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TABLE 2
WASHINGTON: CRUSHED STONE SOLD OR USED, BY KIND 1/

Kind	1996 Number of quarries	1996 Quantity (thousand metric tons)	1996 Value (thousands)	1996 Unit value	1997 Number of quarries	1997 Quantity (thousand metric tons)	1997 Value (thousands)	1997 Unit value
Limestone 2/	8	2,140	$21,900	$10.24	8	1,460	$19,700	$13.49
Dolomite	2	W	W	W	3	463	2,010	4.35
Granite	5	257	1,310	5.10	3	417	2,330	5.60
Traprock	100 r/	11,000	49,000	4.46	87	10,500	56,100	5.34
Sandstone	5	828 r/	3,290	3.96	4	604	5,660	9.37
Slate	5	W	W	W	1	W	W	W
Volcanic cinder and scoria	3	145	1,020	7.00	2	W	W	W
Miscellaneous stone	11	910	4,110	4.51	9	1,040	4,750	4.57
Total	XX	15,400	81,400	5.27	XX	14,700	92,200	6.25

r/ Revised. W Withheld to avoid disclosing company proprietary data; included in "Total." XX Not applicable.
1/ Data are rounded to three significant digits, except unit value; may not add to totals shown.
2/ Includes "limestone-dolomite" reported with no distinction between the two.

TABLE 3
WASHINGTON: CRUSHED STONE SOLD OR USED BY PRODUCERS IN 1997, BY USE 1/ 2/

Use	Quantity (thousand metric tons)	Value (thousands)	Unit value
Coarse aggregate (+1 1/2 inch):			
Riprap and jetty stone	526	$4,560	$8.67
Filter stone	61	257	4.21
Other coarse aggregate	583	3,200	5.49
Coarse aggregate, graded:			
Bituminous aggregate, coarse	85	326	3.84
Bituminous surface-treatment aggregate	31	107	3.45
Railroad ballast	43	253	5.88
Other graded coarse aggregate 3/	117	987	8.44
Fine aggregate (-3/8 inch):			
Stone sand, concrete	276	1,590	5.75
Screening, undesignated	94	384	4.09
Other fine aggregate	(4/)	(4/)	6.51
Coarse and fine aggregates:			
Graded road base or subbase	639	2,740	4.28
Unpaved road surfacing	557	1,670	3.00
Crusher run or fill or waste	991	5,120	5.17
Other coarse and fine aggregates	869	4,390	5.06
Other construction materials 5/	187	1,660	8.86
Agricultural:			
Agricultural limestone	W	W	29.50
Poultry grit and mineral food	W	W	24.25
Chemical and metallurgical:			
Lime manufacture	W	W	5.22
Flux stone	W	W	16.77
Glass manufacture	W	W	20.30
Special:			
Asphalt fillers or extenders	10	31	3.10
Other fillers or extenders	W	W	W
Roofing granules	W	W	19.04
Unspecified: 6/			
Actual	5,450	31,600	5.79
Estimated	3,760	16,400	4.37
Total	14,700	92,200	6.25

W Withheld to avoid disclosing company proprietary data; included in "Total."
1/ Includes dolomite, granite, limestone, limestone-dolomite, miscellaneous stone, sandstone, slate, traprock, and volcanic cinder and scoria.
2/ Data are rounded to three significant digits, except unit value; may not add to totals
3/ Includes concrete aggregate (coarse).
4/ Less than 1/2 unit.
5/ Includes terrazzo and exposed aggregate.
6/ Includes reported and estimated production without a breakdown by end use.

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TABLE 4
WASHINGTON: CRUSHED STONE SOLD OR USED BY PRODUCERS IN 1997,
BY USE AND DISTRICT 1/

(Thousand metric tons and thousand dollars)

Use	District 1		District 2		District 3	
	Quantity	Value	Quantity	Value	Quantity	Value
Construction aggregates:						
Coarse aggregate (+1 1/2 inch) 2/	1,100	7,750	--	--	W	W
Coarse aggregate, graded 3/	160	1,240	W	W	103	383
Fine aggregate (-3/8 inch) 4/	285	1,620	76	315	9	35
Coarse and fine aggregate 5/	2,450	11,500	237	1,310	482	1,970
Other construction materials	W	W	W	W	--	--
Agricultural 6/	--	--	W	W	W	W
Chemical and metallurgical 7/	W	W	--	--	W	W
Special 8/	--	--	W	W	W	W
Unspecified: 9/						
Actual	2,830	20,600	726	1,980	1,900	9,030
Estimated	2,990	12,900	278	1,470	491	2,040
Total	10,000	56,900	1,470	18,100	3,240	17,200

W Withheld to avoid disclosing company proprietary data; included in "Total."
1/ Data are rounded to three significant digits; may not add to totals shown.
2/ Includes filter stone, riprap and jetty stone, and other coarse aggregate.
3/ Includes bituminous aggregate (coarse), bituminous surface-treatment aggregate, railroad ballast, and other graded coarse aggregate.
4/ Includes stone sand (concrete), screening (undesignated), and other fine aggregate.
5/ Includes graded road base or subbase, terrazzo and exposed aggregate, unpaved road surfacing, crusher run (select material or fill), and other coarse and fine aggregates.
6/ Includes agricultural limestone, poultry grit, and mineral food.
7/ Includes flux stone, glass manufacture, and lime manufacture.
8/ Includes asphalt fillers or extenders, other fillers or extenders, and roofing granules.
9/ Includes reported and estimated production without a breakdown by end use.

TABLE 5
WASHINGTON: CONSTRUCTION SAND AND GRAVEL SOLD OR USED IN 1997,
BY MAJOR USE CATEGORY 1/

Use	Quantity (thousand metric tons)	Value (thousands)	Value per ton
Concrete aggregate (including concrete sand)	8,980	$47,300	$5.26
Plaster and gunite sands	19	177	9.32
Concrete products (blocks, bricks, pipe, decorative, etc.)	460	1,120	2.43
Asphaltic concrete aggregates and other bituminous mixtures	3,080	15,300	4.97
Road base and coverings 2/	6,690	32,400	4.85
Fill	6,400	19,400	3.04
Snow and ice control	120	520	4.33
Railroad ballast	240	785	3.27
Other miscellaneous uses 3/	212	1,130	5.32
Unspecified: 4/			
Actual	3,370	12,500	3.71
Estimated	11,000	49,700	4.53
Total or average	40,500	180,000	4.45

1/ Data are rounded to three significant digits; may not add to totals shown.
2/ Includes road and other stabilization (cement and lime).
3/ Includes filtration.
4/ Includes reported and estimated production without a breakdown by end use.

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TABLE 6
WASHINGTON: CONSTRUCTION SAND AND GRAVEL SOLD OR USED IN 1997,
BY USE AND DISTRICT 1/

(Thousand metric tons and thousand dollars)

Use	District 1		District 2		District 3		Unspecified districts	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
Concrete aggregate and concrete products 2/	6,700	40,000	W	W	W	W	--	--
Asphaltic concrete aggregates and other bituminous mixtures	2,430	13,300	387	1,230	260	794	--	--
Road base and coverings 3/	4,890	25,600	839	3,600	962	3,270	--	--
Fill	6,250	19,000	104	342	40	126	--	--
Other miscellaneous uses 4/	422	1,900	W	W	W	W	--	--
Unspecified: 5/								
Actual	1,460	5,300	W	W	W	W	115	503
Estimated	8,940	42,300	1,900	6,940	137	548	--	--
Total	31,100	147,000	4,520	17,700	4,830	15,000	115	503

W Withheld to avoid disclosing company proprietary data; included in "Total."
1/ Data are rounded to three significant digits; may not add to totals shown.
2/ Includes plaster and gunite sands.
3/ Includes road and other stabilization (cement and lime).
4/ Includes fill, railroad ballast, and snow and ice control.
5/ Includes reported and estimated production without a breakdown by end use.

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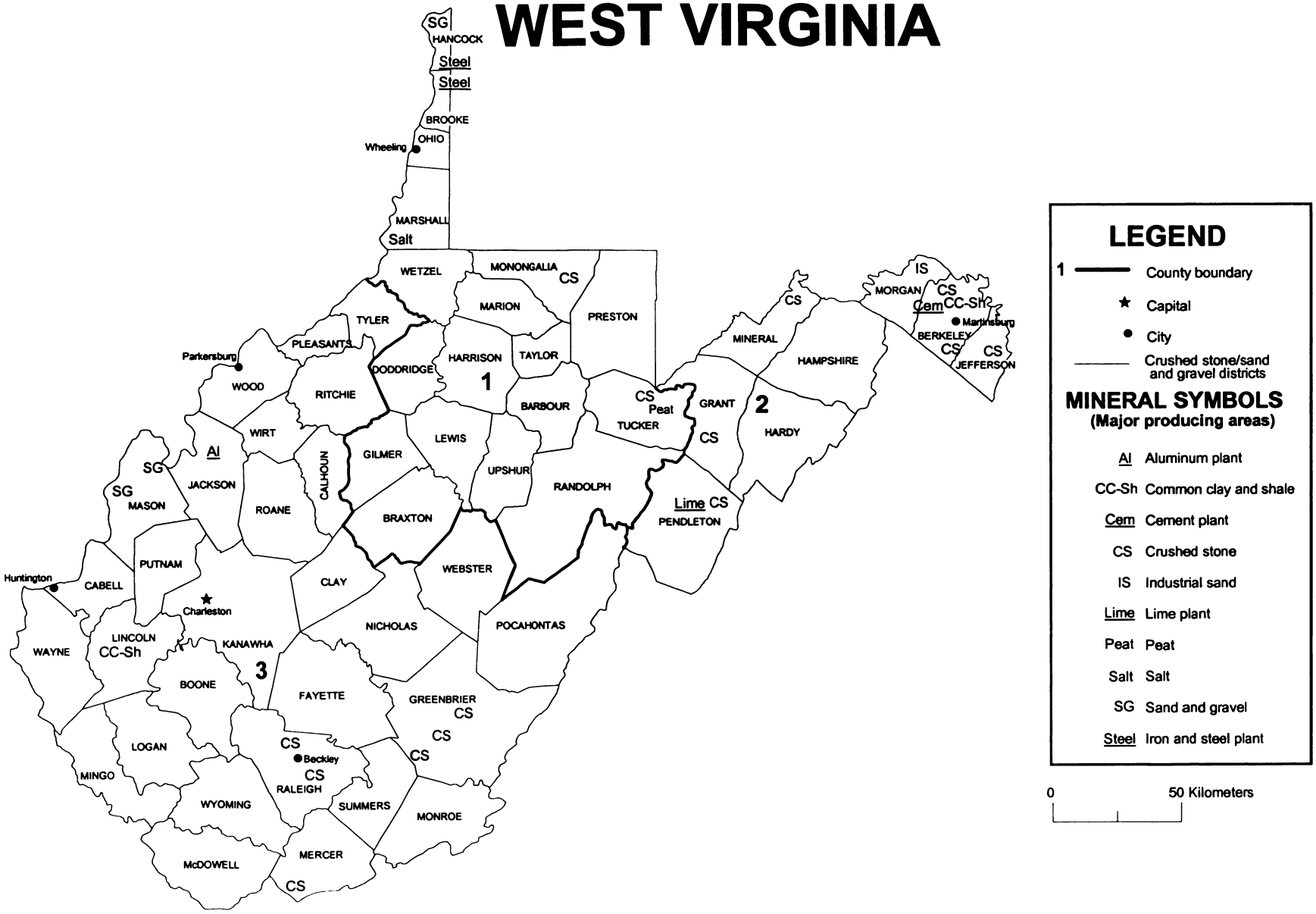
WEST VIRGINIA



LEGEND

1 — County boundary

★ Capital

● City

Crushed stone/sand and gravel districts

MINERAL SYMBOLS
(Major producing areas)

Al	Aluminum plant
CC-Sh	Common clay and shale
Cem	Cement plant
CS	Crushed stone
IS	Industrial sand
Lime	Lime plant
Peat	Peat
Salt	Salt
SG	Sand and gravel
Steel	Iron and steel plant

0 — 50 Kilometers

Source: West Virginia Geological and Economic Survey/U.S. Geological Survey (1998)

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THE MINERAL INDUSTRY OF WEST VIRGINIA

This chapter has been prepared under a Memorandum of Understanding between the U.S. Geological Survey and the West Virginia Geological and Economic Survey for collecting information on all nonfuel minerals.

In 1998, the preliminary estimated value[1] of nonfuel mineral production for West Virginia was $182 million, according to the U.S. Geological Survey (USGS). This was about an 11% decrease from that of 1997,[2] and followed a 10.8% increase in 1997 from that of 1996.

[1]The terms "nonfuel mineral production" and related "values" encompass variations in meaning, depending on the minerals or mineral products. Production may be measured by mine shipments, mineral commodity sales, or marketable production (including consumption by producers) as is applicable to the individual mineral commodity.

All 1998 USGS mineral production data published in this chapter are preliminary estimates as of February 1999 and are expected to change. For some mineral commodities (for example, construction sand and gravel, crushed stone, and portland cement), estimates are updated periodically. To obtain the most current information, please contact the appropriate USGS mineral commodity specialist. A telephone listing for the specialists may be retrieved over the Internet at http://minerals.usgs.gov/minerals/contacts/comdir.html; by using MINES FaxBack at (703) 648-4999 from a fax machine with a touch-tone handset (request Document #1000 for a telephone listing of all mineral commodity specialists); or by calling USGS information at (703) 648-4000 for the specialist's name and number. All Mineral Industry Surveys—mineral commodity, State, and country—also may be retrieved over the Internet at http://minerals.usgs.gov/minerals; facsimile copies may be obtained from MINES FaxBack.

[2]Values, percentage calculations, and rankings for 1997 may vary from the *Minerals Yearbook, Area Reports: Domestic 1997, Volume II*, owing to the revision of preliminary 1997 to final 1997 data. Data for 1998 are preliminary and expected to change, while related rankings may also be subject to change.

Crushed stone was West Virginia's leading nonfuel mineral by value and represented about 43% of the State total. Portland cement, industrial sand and gravel, lime, and salt, in descending order of value, followed. These top five mineral commodities accounted for 92% of the State's total nonfuel mineral production value. The majority of the decrease in value in 1998 resulted from a decrease in the production of crushed stone, which is not shown in table 1. The data were withheld to protect company proprietary data. In 1997, crushed dolomite and portland cement accounted for most of the State's increase in value.

Based on USGS estimates of the quantities of minerals produced in the 50 States in 1998, West Virginia decreased to 10th[2] from 9th in salt; the State also produced significant quantities of cement and crushed stone. West Virginia mines produced only industrial minerals and coal; no metals were mined in the State. Primary aluminum and raw steel were produced in West Virginia, but both metals were processed from materials acquired from foreign and other domestic sources. In 1998, West Virginia, as well as Montana, ranked 11th in the Nation in the production of primary aluminum.

TABLE 1
NONFUEL RAW MINERAL PRODUCTION IN WEST VIRGINIA 1/ 2/

(Thousand metric tons and thousand dollars unless otherwise specified)

	1996		1997		1998 p/	
Mineral	Quantity	Value	Quantity	Value	Quantity	Value
Clays: Common	199	369	151	323	154	329
Gemstones	NA	1	NA	1	NA	1
Sand and gravel: Construction	1,730	7,710	1,670	8,010	1,600	7,860
Stone: Crushed	12,700 3/	78,400 3/	12,900 3/	76,700 3/	13,000	78,000
Combined values of cement, peat, salt, sand and gravel (industrial), stone [crushed dolomite (1996-97), dimension sandstone]	XX	98,600	XX	120,000	XX	96,200
Total	XX	185,000	XX	205,000	XX	182,000

p/ Preliminary. NA Not available. XX Not applicable.
1/ Production as measured by mine shipments, or marketable production (including consumption by producers).
2/ Data are rounded to three significant digits; may not add to totals shown.
3/ Excludes certain stones; kind and value included with "Combined values" data.

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TABLE 2
WEST VIRGINIA: CRUSHED STONE SOLD OR USED BY PRODUCERS, BY KIND 1/

Kind	1996 Number of quarries	1996 Quantity (thousand metric tons)	1996 Value (thousands)	1996 Unit value	1997 Number of quarries	1997 Quantity (thousand metric tons)	1997 Value (thousands)	1997 Unit value
Limestone	36	11,900	$72,400	$6.10	38	12,000	$70,500	$5.86
Dolomite	1	(2/)	(2/)	(2/)	1	(2/)	(2/)	(2/)
Sandstone	9	851	5,970	7.02	8	856	6,180	7.22
Total	XX	12,700	78,400	6.16	XX	12,900	76,700	5.95

XX Not applicable.
1/ Data are rounded to three significant digits; may not add to totals shown.
2/ Excluded from State total to avoid disclosing company proprietary data.

TABLE 3
WEST VIRGINIA: CRUSHED STONE SOLD OR USED BY PRODUCERS IN 1997, BY USE 1/ 2/

Use	Quantity (thousand metric tons)	Value (thousands)	Unit value
Coarse aggregate (+1 1/2 inch):			
Macadam	18	$111	$6.17
Riprap and jetty stone	304	1,990	6.54
Filter stone	147	828	5.63
Other coarse aggregate	80	399	4.99
Coarse aggregate, graded:			
Concrete aggregate, coarse	795	4,330	5.45
Bituminous aggregate, coarse	713	3,700	5.19
Bituminous surface-treatment aggregate	373	2,100	5.62
Railroad ballast	55	314	5.71
Fine aggregate (-3/8 inch):			
Stone sand, concrete	186	1,170	6.31
Stone sand, bituminous mix or seal	313	1,700	5.44
Screening, undesignated	26	185	7.12
Coarse and fine aggregates:			
Graded road base or subbase	366	2,100	5.73
Unpaved road surfacing	30	215	7.17
Crusher run or fill or waste	1,160	6,050	5.21
Other construction materials	172	924	5.37
Agricultural limestone	34	202	5.94
Chemical and metallurgical: Cement manufacture	W	W	1.51
Special:			
Mine dusting or acid water treatment	W	W	24.78
Other fillers or extenders	W	W	24.45
Unspecified: 3/			
Actual	5,130	36,000	7.01
Estimated	1,690	10,700	6.36
Total	12,900	76,700	5.95

W Withheld to avoid disclosing company proprietary data, included in "Total."
1/ Includes limestone, and sandstone; excludes dolomite from State total to avoid disclosing company proprietary data.
2/ Data are rounded to three significant digits, except unit value; may not add to totals shown.
3/ Includes reported and estimated production without a breakdown by end use.

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TABLE 4

WEST VIRGINIA: CRUSHED STONE SOLD OR USED BY PRODUCERS IN 1997, BY USE AND DISTRICT 1/ 2/

(Thousand metric tons and thousand dollars)

Use	District 1		District 2		District 3	
	Quantity	Value	Quantity	Value	Quantity	Value
Construction aggregates:						
Coarse aggregate (+1 1/2 inch) 3/	222	1,220	113	712	215	1,400
Coarse aggregate, graded 4/	668	3,380	380	2,480	W	W
Fine aggregate (-3/8 inch) 5/	96	645	W	W	372	2,130
Coarse and fine aggregate 6/	643	3,390	279	1,690	634	3,280
Other construction materials	172	924	--	--	--	--
Agricultural 7/	W	W	W	W	W	W
Chemical and metallurgical 8/	--	--	W	W	--	--
Special 9/	W	W	--	--	--	--
Unspecified: 10/						
Actual	3,310	23,500	293	2,940	1,530	9,500
Estimated	640	4,720	692	4,170	358	1,860
Total	5,850	39,800	3,050	14,200	3,990	22,700

W Withheld to avoid disclosing company proprietary data; included in "Total."
1/ Excludes dolomite from State total to avoid disclosing company proprietary data.
2/ Data are rounded to three significant digits; may not add to totals shown.
3/ Includes filter stone, macadam, riprap and jetty stone, and other coarse aggregate.
4/ Includes concrete aggregate (coarse), bituminous aggregate (coarse), bituminous surface-treatment aggregate, and railroad ballast.
5/ Includes stone sand (concrete), stone sand (bituminous mix or seal), and screening (undesignated).
6/ Includes graded road base or subbase, unpaved road surfacing, and cursher run (select material or fill).
7/ Includes agricultural limestone.
8/ Includes cement manufacture.
9/ Includes mine dusting or acid water treatment and other fillers or extenders.
10/ Includes reported and estimated production without a breakdown by end use.

TABLE 5

WEST VIRGINIA: CONSTRUCTION SAND AND GRAVEL SOLD OR USED IN 1997, BY MAJOR USE CATEGORY 1/ 2/

Use	Quantity (thousand metric tons)	Value (thousands)	Value per ton
Concrete aggregate (including concrete sand) 3/	179	$1,250	$6.99
Concrete products (blocks, bricks, pipe, decorative, etc.)	82	$420	5.12
Asphaltic concrete aggregates and other roadbase material	171	782	4.57
Fill	132	560	4.24
Snow and ice control	36	110	3.06
Other miscellaneous uses	9	46	5.11
Unspecified: Actual 4/	1,060	4,840	4.55
Total or average	1,670	8,010	4.79

1/ To avoid disclosing company proprietary data, no district tables were produced for 1997.
2/ Data are rounded to three significant digits; may not add to totals shown.
3/ Includes plaster and gunite sands.
4/ Includes reported and estimated production without a breakdown by end use.

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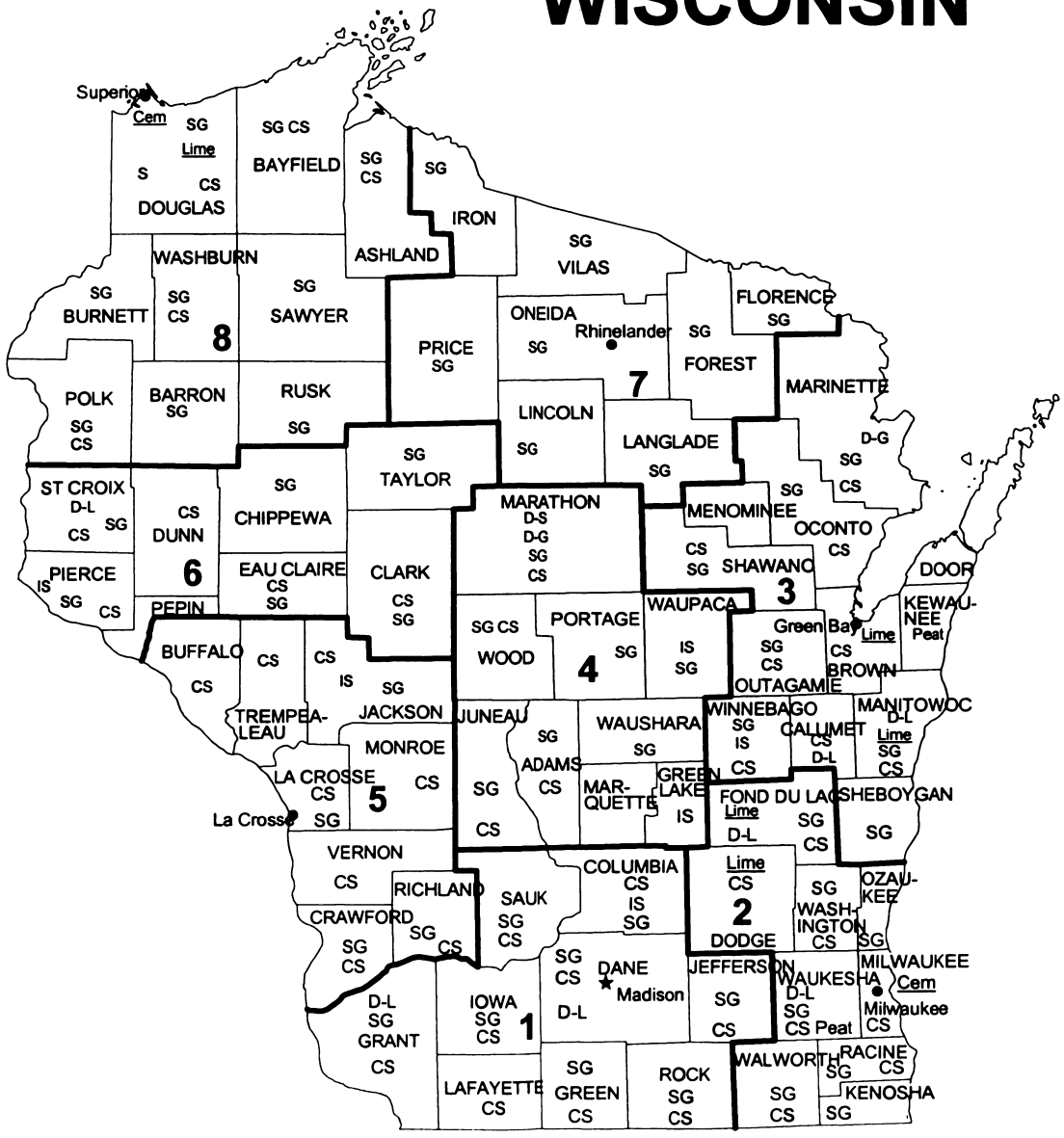

LEGEND

- County boundary
- ★ Capital
- ● City
- 1 — Crushed stone/sand and gravel districts

MINERAL SYMBOLS
(Major producing areas)

Cem	Cement plant
CS	Crushed stone
D-G	Dimension granite
D-L	Dimension limestone
D-S	Dimension sandstone
IS	Industrial sand
Lime	Lime plant
Peat	Peat
SG	Sand and gravel
S	Sulfur (recovered)

0 50 Kilometers

Source: Wisconsin Geological and Natural History Survey/U.S. Geological Survey (1998)

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THE MINERAL INDUSTRY OF WISCONSIN

This chapter has been prepared under a Memorandum of Understanding between the U.S. Geological Survey and the Wisconsin Geological and Natural History Survey for collecting information on all nonfuel minerals.

In 1998, the preliminary estimated value[1] of nonfuel mineral production for Wisconsin was $296 million, according to the U.S. Geological Survey (USGS). This was a decrease of about 17% from that of 1997,[2] and followed a 9.6% decrease in 1997 from that of 1996.

Crushed stone and construction sand and gravel were, by value, Wisconsin's leading nonfuel minerals in 1998, accounting for about 37% and almost 35%, respectively, of the State's total nonfuel mineral value. In 1998, the most significant portion of the State's decrease in value resulted from the cessation of copper and gold production following the 1997 closing of the Flambeau Mine, Rusk County. Other mineral commodities showing a decrease in value included construction sand and gravel, crushed stone, and dimension stone. Lime and silica stone showed small increases, while gemstones and peat values were unchanged. Similar to that of 1998, substantial decreases in the production and values of copper and gold in 1997 accounted for the majority of Wisconsin's decrease that year. Additionally, in 1997, increases occurred in the values of crushed stone, construction sand and gravel, lime, industrial sand and gravel, and silica stone (descending order of magnitude of change); decreases occurred in dimension stone, peat, silver, and gemstones (table 1).

Based on USGS estimates of quantities of minerals produced in the 50 States for 1998, Wisconsin rose to third[2] from fourth in dimension stone, while it remained second of 3 States that produce silica stone and fifth in industrial sand and gravel. Additionally, the State was a significant producer of construction sand and gravel, crushed stone, and lime.

The following narrative information was provided by the Wisconsin Geological and Natural History Survey (WGNHS).[3] Regulatory review of the proposed underground zinc-copper Crandon Mine project in Forest County continued in 1998, a year highlighted by a significant change in the ownership of the proposed project and subsequent mine-design evaluations and changes that followed. In January, Rio Algom Ltd. announced it had purchased the project's 50% interest of Exxon Coal and Minerals Co. for $17.5 million. A new company, Nicolet Minerals Co., was formed to replace the Crandon Mining Co. and to carry forward permitting activities with the State and Federal Governments. In March, Nicolet Minerals announced plans to conduct a series of tests to evaluate possible mine-design changes to address certain environmental concerns related to the proposed mine.

In December, as a result of Nicolet's tests and evaluations, the company announced major changes in the mining plan. Grout emplacement would be used while mining the ore to reduce groundwater flow into the mine workings. Reduced mine inflow, in turn, would allow the use of advanced water treatment technologies, such as reverse osmosis, which require a low volume of water for effective treatment. The reduced groundwater flow also will decrease the mining operation's effect on the elevation of the existing watertable. In addition, plans for a 38-mile water discharge pipeline were abandoned. Under the original expectations of water flow into the mine, the pipeline would have been needed for disposal of treated wastewater into the Wisconsin River. The company decided to use groundwater infiltration cells for disposing of excess treated mine wastewater. Another major change in the proposed mining project is that sulfide-bearing materials, such as pyrite, will be removed from the proposed tailings, thereby reducing the size of the tailings management area and the acid-generation potential of the tailings.

Review of the Nicolet Minerals' Crandon Mine project is expected to take between 2 and 3 years after the company has completed filing all of its amended permit applications and other environmental impact report studies documenting the company's assessment of potential environmental and socioeconomic impacts.

In the industrial minerals industry, crushed stone and construction sand and gravel producers reported that overall it was a good year, one of significant activity. Of particular note, was the production and sales of railroad ballast from the central Wisconsin granite area. As well as being produced as crushed stone, dimension stone was also produced from the State's sandstone, dolomite, and granite resources. The granite dimension stone industry remained strong in 1998; some producers invested capital into the modernization of their production and cutting facilities. Some dimension stone products that were produced included countertop material, tile, and surface plates, in addition to the more traditional

[1]The terms "nonfuel mineral production" and related "values" encompass variations in meaning, depending on the minerals or mineral products. Production may be measured by mine shipments, mineral commodity sales, or marketable production (including consumption by producers) as is applicable to the individual mineral commodity.

All 1998 USGS mineral production data published in this chapter are preliminary estimates as of February 1999 and are expected to change. Construction sand and gravel and crushed stone estimates are updated periodically. To obtain the most current information, please contact the appropriate USGS mineral commodity specialist. A telephone listing for the specialists may be retrieved over the Internet at http://minerals.usgs.gov/minerals/contacts/comdir.html; by using MINES FaxBack at (703) 648-4999 from a fax machine with a touch-tone handset (request Document #1000 for a telephone listing of all mineral commodity specialists); or by calling USGS information at (703) 648-4000 for the specialist's name and number. All Mineral Industry Surveys—mineral commodity, State, and country—also may be retrieved over the Internet at http://minerals.usgs.gov/minerals; facsimile copies may be obtained from MINES FaxBack.

[2]Values, percentage calculations, and rankings for 1997 may vary from the *Minerals Yearbook, Area Reports: Domestic 1997, Volume II*, owing to the revision of preliminary 1997 to final 1997 data. Data for 1998 are preliminary and expected to change, while related rankings may also be subject to change.

[3]Thomas J. Evans, Geologist, authored the text of mineral industry information submitted by the WGNHS.

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production, such as that of monuments. Silica sand producers reported an active year for foundry and hydrofrac sand.

The Wisconsin Department of Transportation held a demonstration project on the use of recycled materials in roadbase. Foundry sand, pottery cull, and mixed glass were waste products that were evaluated for recycle use as roadbase. Recycled materials in transportation applications, however, are not expected to provide a significant portion of material used in the near future.

While 1998 was a year marked by significant legislative and policy activity for metallic mining, very limited leasing and exploration activity took place for metallic mineral resources. Exploration activity consisted of the construction of one drill hole on a previously known discovery. Sharpe Resources Corp. constructed a deep, near vertical hole on the Bend deposit in the Chequamegon National Forest near Perkinstown in Taylor County. Metallic mineral leasing activity appears to have been extremely limited, as well. The WGNHS assessed that the decline in leasing and exploration activity in the State represented industry investment in exploration being focused in other areas of the United States and North America (Canada and Mexico), as well as industry adopting a "wait-and-see" attitude with respect to the permitting activities currently underway for Nicolet Minerals' proposed mine near Crandon.

Legislation and Government Activities

Legislative activity in 1998 featured the passage of State Senate Bill 3, the so-called mining moratorium bill. Signed by the State Governor on April 22, the bill imposes a requirement that a mining applicant submit documentation regarding the successful operation and reclamation of mines having a net acid-generating potential. The new law, despite its common characterization, does not impose a moratorium on metal mining operations in Wisconsin, but does create an additional condition that must be met by an applicant seeking a mining permit. Other legislative activity in 1998 included the acceptance of new administrative rules, adopted by the Wisconsin Department of Natural Resources (DNR), which create a more uniform approach to groundwater regulation among all regulated activities within the State. Previously, groundwater protection rules that applied to metal mining operations differed to some degree from the broader groundwater law that had been adopted for other operations. Also proposed in 1998, were administrative rules creating an irrevocable trust fund for metal mines permitted in Wisconsin. This so-called "Mine Disaster Fund" is intended to provide for a significant sum of money to pay for mitigation of unforseen disasters associated with mining many years in the future. The amount of money placed in the interest-bearing account would be determined following testimony submitted by all parties at a "Master Hearing." This proposal, submitted for review by the Legislature, remains controversial because it does not set a minimum fee that must be included in the fund, but instead relies on the funding level and schedule for accumulation of the fund in the irrevocable trust being determined by the administrative law judge, based on testimony submitted, at the Master Hearing.

The Wisconsin Science Advisory Council met several times during the year. Created by a 1997 gubernatorial executive order, the five-member council of independent scientists is directed to evaluate the technologies proposed for use in preventing environmental degradation by a mining applicant. The council will make recommendations to the Secretary of the State's DNR regarding the status of such technology in general and the application of such technology for a specific mine proposal. The Council has been reviewing Nicolet Minerals' plans for its proposed mine near Crandon.

On the local level, Nashville, Forest County, rescinded a mineral lease agreement that it had signed with Exxon in 1975 and assigned to Crandon Mining Co. in 1993. Reasons provided included the town's assertions that Exxon ceased mineral development activities for more than 180 days and thereby abrogated the lease agreement, that the lease agreement essentially conveyed public property to a private entity without requiring that the property be put to public use, and that the town board originally signing the agreement in 1975 did so illegally. The mineral lease agreement relates to rights to minerals beneath the town road near the Crandon ore body. In May, a Circuit Court judge ruled that the local agreements signed by the Towns of Nashville and Lincoln, the City of Crandon, and Forest County remain in effect. A private individual and the Wisconsin Resource Protection Council had sought to have the agreements nullified, but the judge ruled that the agreements were "valid and legal contracts, negotiated in good faith."

Mine Reclamation

Immediately following the 1997 closing of the Flambeau Mine, located just south of Ladysmith in Rusk County, the Flambeau Mining Co. began a reclamation program. The program most notably included filling the 32-acre pit created from the extraction of copper and gold ore from the volcanogenic massive-sulfide deposit. In 1998, Flambeau approached the Wisconsin DNR for permission to modify the approved reclamation plan to accommodate local interest in retaining the mine buildings for subsequent use in a small, industrial park development. The company also requested plan changes involving fencing, electrical service, and location of restored wetlands. Some local citizens, concerned with various aspects of the proposed changes, objected. An informal informational meeting was held in Ladysmith to determine whether the modifications requested might make a formal contested-case hearing necessary. Fortunately, a consensus was reached on the scope and nature of the proposed modifications and the reclamation plan was amended with the permission approval of the DNR without the need to hold the formal hearing. Subsequently, the pit was filled, the site was reshaped and revegetated with local plant species, and at the end of 1998 wetlands were undergoing restoration.

There was relatively little progress in efforts to enact new administrative rules related to the reclamation of nonmetallic mineral mining operations; those rules proposed in government committee meetings were subsequently withdrawn pending further negotiations between legislative staff, committee members, and industry representatives.

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TABLE 1
NONFUEL RAW MINERAL PRODUCTION IN WISCONSIN 1/ 2/

(Thousand metric tons and thousand dollars unless otherwise specified)

Mineral	1996		1997		1998 p/	
	Quantity	Value	Quantity	Value	Quantity	Value
Gemstones	NA	505	NA	5	NA	5
Lime	551	32,000	597	35,100	618	35,200
Peat	W	W	5	256	8	256
Sand and gravel:						
Construction	32,600	105,000	33,500	110,000	30,600	103,000
Industrial	1,660	32,300	1,710	33,800	1,730	34,000
Stone:						
Crushed	26,000	113,000	28,700	120,000	27,600	110,000
Dimension metric tons	143,000	16,600	100,000	13,100	101,000	12,800
Combined values of other industrial minerals	XX	96,800	XX	46,600	XX	(3/)
Total	XX	396,000	XX	358,000	XX	296,000 4/

p/ Preliminary. NA Not available. W Withheld to avoid disclosing company proprietary data. XX Not applicable.
1/ Production as measured by mine shipments, sales; or marketable production (including consumption by producers).
2/ Data are rounded to three significant digits; may not add to totals shown.
3/ Value excluded to avoid disclosing company proprietary data.
4/ Partial total, excludes values that must be concealed to avoid disclosing company proprietary data.

TABLE 2
WISCONSIN: CRUSHED STONE SOLD OR USED BY PRODUCERS BY KIND 1/

Kind	1996				1997			
	Number of quarries	Quantity (thousand metric tons)	Value (thousands)	Unit value	Number of quarries	Quantity (thousand metric tons)	Value (thousands)	Unit value
Limestone 2/	162 r/	20,000 r/	$89,500 r/	$4.47 r/	151	20,800	$90,700	$4.36
Dolomite	8 r/	1,090 r/	4,530 r/	4.16 r/	10	1,560	6,570	4.20
Granite	6	1,350	2,690	2.00	7	2,210	4,790	2.17
Traprock	3	1,690	7,880	4.68	3	2,080	8,320	4.01
Sandstone and quartzite	4	1,890	8,290	4.39	4	2,070	9,300	4.50
Total	XX	26,000	113,000	4.34	XX	28,700	120,000	4.16

r/ Revised. XX Not applicable.
1/ Data are rounded to three significant digits; may not add to totals shown.
2/ Includes "limestone-dolomite" reported with no distinction between the two.

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TABLE 3
WISCONSIN: CRUSHED STONE SOLD OR USED BY PRODUCERS
IN 1997, BY USE 1/ 2/

Use	Quantity (thousand metric tons)	Value (thousands)	Unit value
Coarse aggregate (+1 1/2 inch):			
Riprap and jetty stone	246	$1,460	$5.92
Filter stone	119	513	4.31
Other coarse aggregate 3/	1,240	5,430	4.39
Coarse aggregate, graded:			
Concrete aggregate, coarse	940	4,450	4.73
Bituminous aggregate, coarse	349	1,710	4.90
Bituminous surface-treatment aggregate	137	340	2.48
Railroad ballast	15	77	5.13
Other graded coarse aggregate	163	759	4.66
Fine aggregate (-3/8 inch):			
Stone sand, bituminous mix or seal	24	91	3.79
Screening, undesignated	608	2,120	3.49
Other fine aggregate 4/	22	86	3.91
Coarse and fine aggregates:			
Graded road base or subbase	7,540	29,800	3.95
Unpaved road surfacing	1,030	2,260	2.19
Crusher run or fill or waste	560	1,970	3.51
Other coarse and fine aggregates 5/	837	3,400	4.07
Other construction materials	19	76	4.00
Agricultural:			
Agricultural limestone	425	3,340	7.87
Other agricultural uses	1	2	2.00
Chemical and metallurgical: Lime manufacture	W	W	W
Special:			
Other fillers or extenders	10	53	5.30
Roofing granules	274	302	1.10
Other specified uses not listed	W	W	W
Unspecified: 6/			
Actual	7,310	32,000	4.38
Estimated	6,640	28,500	4.29
Total	28,700	120,000	4.16

W Withheld to avoid disclosing company proprietary data; included in "Total."
1/ Includes dolomite, granite, limestone, limestone-dolomite, sandstone and quartzite, and traprock.
2/ Data are rounded to three significant digits; may not add to totals shown.
3/ Includes macadam.
4/ Includes stone sand (concrete).
5/ Includes terrazzo and exposed aggregate.
6/ Includes reported and estimated production without a breakdown by end use.

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TABLE 4
WISCONSIN: CRUSHED STONE SOLD OR USED BY PRODUCERS IN 1997,
BY USE AND DISTRICT 1/ 2/

(Thousand metric tons and thousand dollars)

Use	District 1		District 2		District 3		District 4	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
Construction aggregates:								
Coarse aggregate (+1 1/2 inch) 3/	152	582	1,270	5,650	131	802	W	W
Coarse aggregate, graded 4/	123	420	1,040	5,270	407	1,500	--	--
Fine aggregate (-3/8 inch) 5/	135	496	W	W	247	769	W	W
Coarse and fine aggregate 6/	3,770	16,000	2,090	8,250	2,410	8,030	1,230	2,450
Other construction materials	--	--	--	--	19	77	--	--
Agricultural 7/	212	1,080	W	W	W	W	--	--
Chemical and metallurgical 8/	--	--	--	--	W	W	--	--
Special 9/	10	54	--	--	W	W	--	--
Unspecified: 10/								
Actual	511	2,510	--	--	--	--	2,410	8,440
Estimated	1,170	5,080	1,080	4,940	2,290	9,030	312	1,600
Total	6,080	26,200	5,860	26,600	5,740	21,200	3,950	12,500

	District 5		District 6		District 8	
	Quantity	Value	Quantity	Value	Quantity	Value
Construction aggregates:						
Coarse aggregate (+1 1/2 inch) 3/	W	W	--	--	W	W
Coarse aggregate, graded 4/	W	W	--	--	W	W
Fine aggregate (-3/8 inch) 5/	W	W	--	--	--	--
Coarse and fine aggregate 6/	W	W	21	106	W	W
Other construction materials	--	--	--	--	--	--
Apricultural 7/	W	W	15	201	25	209
Chemical and metallurgical 8/	--	--	--	--	--	--
Special 9/	--	--	--	--	--	--
Unspecified: 10/						
Actual	3,320	15,800	957	4,580	116	623
Estimated	36	166	69	309	1,690	7,400
Total	3,950	18,800	1,060	5,190	2,100	9,210

W Withheld to avoid disclosing company proprietary data; included in "Total."
1/ No crushed stone was produced in District 7.
2/ Data are rounded to three significant digits; may not add to totals shown.
3/ Includes filter stone, macadam, riprap and jetty stone, and other coarse aggregate.
4/ Includes concrete aggregate (coarse), bituminous aggregate (coarse), bituminous surface-treatment aggregate, railroad ballast, and other graded coarse aggregate.
5/ Includes stone sand (concrete), stone sand (bituminous mix or seal), screening (undesignated), and other fine aggregate.
6/ Includes graded road base or subbase, terrazzo and exposed aggregate, unpaved road surfacing, crusher run (select material or fill), and other coarse and fine aggregates.
7/ Includes agricultural limestone and other agricultural uses.
8/ Includes lime manufacture.
9/ Includes other fillers or extenders and other specified uses not listed, and roofing granules.
10/ Includes reported and estimated production without a breakdown by end use.

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TABLE 5
WISCONSIN: CONSTRUCTION SAND AND GRAVEL SOLD OR USED IN 1997,
BY MAJOR USE CATEGORY 1/

Use	Quantity (thousand metric tons)	Value (thousands)	Value per ton
Concrete aggregate (including concrete sand)	7,950	$32,100	$4.04
Plaster and gunite sands	18	128	7.11
Concrete products (blocks, bricks, pipe, decorative, etc.)	249	1,350	5.43
Asphaltic concrete aggregates and other bituminous mixtures	2,260	8,090	3.57
Road base and coverings 2/	6,920	17,700	2.56
Fill	858	1,970	2.30
Snow and ice control	173	575	3.32
Roofing granules	12	71	5.92
Other miscellaneous uses 3/	141	659	4.67
Unspecified: 4/			
Actual	7,880	26,600	3.38
Estimated	7,040	20,800	2.95
Total or average	33,500	110,000	3.28

1/ Data are rounded to three significant digits; may not add to totals shown.
2/ Includes road and other stabilization (cement and lime).
3/ Includes filtration and railroad ballast.
4/ Includes reported and estimated production without a breakdown by end use.

TABLE 6
WISCONSIN: CONSTRUCTION SAND AND GRAVEL SOLD OR USED IN 1997,
BY USE AND DISTRICT 1/

(Thousand metric tons and thousand dollars)

Use	District 1		District 2		District 3	
	Quantity	Value	Quantity	Value	Quantity	Value
Concrete aggregate and concrete products 2/	1,430	5,810	4,520	18,400	1,140	4,550
Asphaltic concrete aggregates and other bituminous mixtures	665	3,520	240	915	704	1,590
Road base and coverings 3/	747	2,550	2,750	6,670	1,080	2,490
Fill	W	W	W	W	141	253
Snow and ice control	W	W	25	90	W	W
Other miscellaneous uses 4/	W	W	44	176	W	W
Unspecified: 5/						
Actual	1,590	5,690	W	W	--	--
Estimated	248	764	1,640	5,240	1,160	2,810
Total	4,920	19,200	14,200	47,700	4,240	11,800

Use	District 4		District 5		District 6	
	Quantity	Value	Quantity	Value	Quantity	Value
Concrete aggregate and concrete products 2/	238	1,370	W	W	182	694
Asphaltic concrete aggregates and other bituminous mixtures	W	W	W	W	182	405
Road base and coverings 3/	191	800	--	--	1,040	2,700
Fill	W	W	W	W	74	131
Snow and ice control	18	66	20	53	W	W
Other miscellaneous uses 4/	W	W	--	--	W	W
Unspecified: 5/						
Actual	W	W	W	W	--	--
Estimated	378	1,130	66	214	1,730	5,770
Total	1,270	4,590	327	1,050	3,250	9,860

Use	District 7		District 8		Unspecified districts 6/	
	Quantity	Value	Quantity	Value	Quantity	Value
Concrete aggregate and concrete products 2/	W	W	302	1,140	272	1,200
Asphaltic concrete aggregates and other bituminous mixtures	95	266	350	1,310	--	--
Road base and coverings 3/	183	351	928	2,190	--	--
Fill	--	--	47	71	--	--
Snow and ice control	W	W	W	W	--	--
Other miscellaneous uses 4/	W	W	W	W	--	--
Unspecified: 5/						
Actual	--	--	--	--	1,120	3,960
Estimated	893	2,460	935	2,380	--	--
Total	1,280	3,390	2,600	7,260	1,390	5,160

W Withheld to avoid disclosing company proprietary data; included in "Total."
1/ Data are rounded to three significant digits; may not add to totals shown.
2/ Includes plaster and gunite sands.
3/ Includes road and other stabilization (cement and lime).
4/ Includes filtration, railroad ballast, and roofing granules.
5/ Includes reported and estimated production without a breakdown by end use.
6/ Includes production within the State with no district reported.

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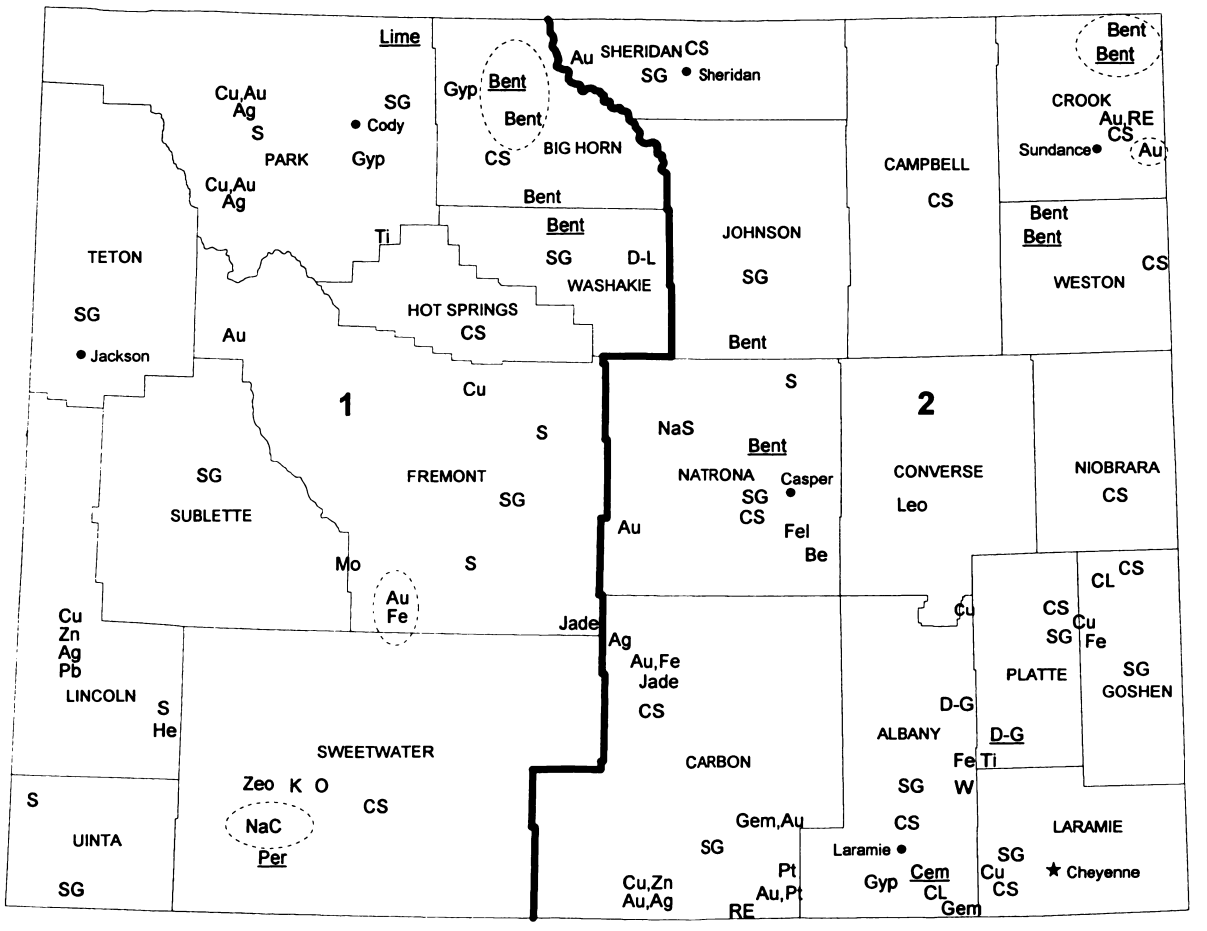
WYOMING



* Metals exploration activities are included on this map.

LEGEND

- County boundary
- ★ Capital
- • City
- 1 — Crushed stone/sand and gravel districts

MINERAL SYMBOLS

(Major producing areas) *

Ag	Silver
Au	Gold
Be	Beryllium
Bent	Bentonite
Bent	Bentonite mill
Cem	Cement plant
CL	Crushed limestone
CS	Crushed stone
Cu	Copper
D-G	Dimension granite
D-G	Dimension granite plant
D-L	Dimension limestone
Fe	Iron
Fel	Feldspar
Gem	Diamonds
Gyp	Gypsum
He	Helium
Jade	Jade
K	Potash
Leo	Leonardite
Lime	Lime plant
Mo	Molybdenum
NaC	Sodium carbonate
NaS	Sodium sulfate
O	Olivine
Per	Perlite plant
Pt	Platinum-group metals
Pb	Lead
RE	Rare earths
S	Sulfur
SG	Sand and gravel
Ti	Titanium
W	Tungsten
Zeo	Zeolites
Zn	Zinc
	Concentration of mineral operations

0 100 Kilometers

Source: Wyoming State Geological Survey/U.S. Geological Survey (1998)

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THE MINERAL INDUSTRY OF WYOMING

This chapter has been prepared under a Memorandum of Understanding between the U.S. Geological Survey and the Wyoming State Geological Survey for collecting information on all nonfuel minerals.

In 1998, the preliminary estimated value[1] of nonfuel mineral production for Wyoming was $1.06 billion, according to the U.S. Geological Survey (USGS). This was about a 5% decrease from that of 1997,[2] and followed a 3.7% increase from 1996 to 1997. The State ranked 13th (12th in 1997) among the 50 States in total nonfuel mineral production value, of which Wyoming accounted for more than 2.5% of the U.S. total.

Wyoming's leading nonfuel mineral, by value, was soda ash, followed by bentonite, grade-A helium, and portland cement. In 1998, decreases in the values of soda ash and bentonite (descending order of change) accounted for nearly all of the State's drop in value (table 1). Crushed stone, construction sand and gravel, grade-A helium, and portland cement showed small to moderate gains; all other mineral commodities slightly increased or remained unchanged. In 1997, substantial increases in the values of bentonite and grade-A helium accounted for most of Wyoming's increase in value. Only lime and to a lesser extent soda ash and construction sand and gravel showed any significant decreases for the year.

Based on USGS estimates of the quantities of minerals produced in the 50 States during 1998, Wyoming remained first[2] in soda ash and bentonite (descending order of value), second in grade-A helium, and fifth in zeolites. Soda ash (sodium carbonate) is an inorganic chemical extensively used in the manufacture of glass, paper, soap and detergents, textiles, and as sodium bicarbonate in food products. The United States is the world's largest producer of soda ash. Wyoming, one of only two producing States, is home to the world's largest known natural deposit of trona. Trona is the principal ore from which soda ash is refined. California produces a significantly smaller quantity of natural soda ash. Wyoming has not had significant metal production since iron ore mining ceased in April 1984.

[1]The terms "nonfuel mineral production" and related "values" encompass variations in meaning, depending on the minerals or mineral products. Production may be measured by mine shipments, mineral commodity sales, or marketable production (including consumption by producers) as is applicable to the individual mineral commodity.

All 1998 USGS mineral production data published in this chapter are preliminary estimates as of February 1999 and are expected to change. For some mineral commodities (for example, construction sand and gravel, crushed stone, and portland cement), estimates are updated periodically. To obtain the most current information, please contact the appropriate USGS mineral commodity specialist. A telephone listing for the specialists may be retrieved over the Internet at http://minerals.usgs.gov/minerals/contacts/comdir.html; by using MINES FaxBack at (703) 648-4999 from a fax machine with a touch-tone handset (request Document #1000 for a telephone listing of all mineral commodity specialists); or by calling USGS information at (703) 648-4000 for the specialist's name and number. All Mineral Industry Surveys—mineral commodity, State, and country—also may be retrieved over the Internet at http://minerals.usgs.gov/minerals; facsimile copies may be obtained from MINES FaxBack.

[2]Values, percentage calculations, and rankings for 1997 may vary from the *Minerals Yearbook, Area Reports: Domestic 1997, Volume II*, owing to the revision of preliminary 1997 to final 1997 data. Data for 1998 are preliminary and expected to change, while related rankings may also be subject to change.

The Wyoming State Geological Survey (WSGS) provided the following narrative information.[3] The WSGS reported that 1998 was a very active year for the State's minerals industry and the WSGS in regard to industrial minerals, especially diamonds and other precious stones, and in the exploration for gold.

Industrial Minerals

Based on WSGS surveys and estimates, bentonite production continued at record levels in 1998. Expanding markets for most uses of bentonite contributed to this increase, especially the growing market for kitty litter.

Trona production was down in 1998 from the record production of 1997. This decline was due mainly to smaller orders for soda ash from the far East, owing to that region's economic difficulties. A few companies that expected smaller production during the next several years postponed expansion plans.

In early 1998, interest arose with regard to the construction of a glass plant in Wyoming for the production of brown glass beer bottles. Anheuser-Busch, Inc., Budweiser Division, which operates a brewery in Wellington, CO, about 48 kilometers south of Cheyenne, WY, announced that it was seeking an increased beer bottle supply and was accepting bids for bottles. At midyear at least two major container glass manufacturers bid for the bottle contract. Wyoming was to be the preferred location for new bottle production. However, by yearend, Budweiser announced that it was extending its existing contract with Ball-Foster Glass in Oklahoma for a year while it evaluated the whole situation to include the test marketing of plastic bottles by another beer producer.

The production of chemical grade limestone in Wyoming continued to increase in 1998. Basins Electric, Inc., which operates the Laramie River coal-fired powerplant just north of Wheatland, changed its source of limestone used for emissions control from Divide Construction's Bass Quarry to Colorado Lien's Hartville Quarry. In the Hartville Quarry, 32 kilometers closer to the powerplant than the Bass Quarry, the source material is the Mississippian-Devonian Guernsey Limestone, the same unit quarried at the Bass Quarry. Exploration for additional chemical grade and aggregate quality limestone resources continued, especially near the limestone and aggregate poor Powder River Basin and the western Green River Basin.

Railroad ballast is an important construction material produced in the State at Meridian Aggregate Co.'s Granite Cañon Quarry west of Cheyenne and by Guernsey Stone at

[3]Ray E. Harris, Industrial Minerals and Uranium Geologist, and W. Dan Hausel, Senior Economic Geologist (Metals), both of the Wyoming State Geological Survey, coauthored the text of mineral industry information submitted by that agency.

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Guernsey. The Burlington Northern Railroad was in the process of double-tracking its main lines to the coal fields, and the Dakota, Minnesota, and Eastern Railroad was planning the construction of a new line into the coal mining area. Both of these projects will require rock for base, subbase, and ballast. Several companies had of late been testing sources for these materials near the areas of construction.

Raven Quarries, which produces a black granite, Wyoming Raven, and a pink swirled granite, Fantastico, added another pink granite, called Mirage, to its product line. Mirage is quarried adjacent to the Wyoming Raven Quarry. Raven Quarries closed its Wyoming fabricating plant in 1998. It now ships all of its quarried blocks to Western Granite in Tijuana, Mexico, for processing. At yearend, one Italian company was obtaining permits to quarry dimension limestone near Horse Creek in Laramie County, and at least three other companies had acquired quarriable stone deposits. Exploration and expansion continued for dimension stone resources in the State.

U.S. Zeolites, which mined 1,360 metric tons of the zeolite clinoptilolite southeast of Bitter Creek, in Sweetwater County in 1997, was sold to Addwest Minerals International Ltd., of Denver, CO. In 1998, Addwest hauled some stockpiled ore from the mine to a facility in Utah for refining and shipping to markets. About 900 tons of clinoptilolite ore are stockpiled at the mine site.

During 1998, the Wyoming State Legislature increased the WSGS's diamond research budget to allow for geochemical analyses of kimberlitic indicator minerals, geologic mapping, diamond testing, and remote sensing in the search for potential diamondiferous host rocks. The WSGS began reconnaissance in the Bighorn Basin in northwestern part of the State and in the Laramie Mountains and Hartville uplift in eastern Wyoming. Initial reconnaissance in the Bighorn Basin recovered some rounded, pink, red (with slight purple coloration), and yellow-orange garnets. One garnet yielded an index of refraction of less than 1.760, characteristic of pyrope, although the presence of pyrope was not yet confirmed by geochemical analyses.

Sampling and mapping continued in the Iron Mountain district in the Laramie Mountains, 56 kilometers northwest of Cheyenne. Several previously unknown kimberlites were mapped by the WSGS during the 1997 and 1998 field seasons. Based on the recent mapping, four major kimberlite dike/blow complexes occur in the district—the largest has a strike length of 4 kilometers with scattered blows ranging from 10 meters to 300 meters across. Additionally, a kimberlite sill was discovered in the district; other evidence suggested other kimberlites may be found. This optimism was based on kimberlitic indicator mineral anomalies upstream from any known kimberlite, the presence of topographic lows along kimberlite trends, and the presence of extensive Tertiary conglomerates containing kimberlitic picroilmenite megacrysts that cut across the known kimberlite trends, possibly concealing undiscovered kimberlites.

Geochemical analyses of kimberlitic indicator minerals from Iron Mountain suggest some intrusives originated within the diamond stability field. Both calcic (G9) and subcalcic (G10) chrome-pyropes have been recovered and a small number of eclogitic garnets also yielded favorable chemistries. The WSGS planned the testing of samples for diamonds in the near future. During 1998, a new report on diamonds was released by the WSGS entitled, *Diamonds and Mantle Source Rocks in the Wyoming Craton, With a Discussion of Other US Occurrences* (Hausel, 1998).

The WSGS continued to accumulate information on other gemstones, semiprecious stones, ornamental stones, and lapidary materials. In addition to diamond, minerals of interest included (roughly in order of interest) jade, ruby, sapphire, aquamarine, garnet, chrome diopside and enstatite, cordierite, agate, jasper, and gold. Field investigations of lamproite in the Leucite Hills of southwestern part of the State, led to the discovery of peridot (gem-quality olivine). The olivine was found in anthills adjacent to one of the lamproites. Several thousand carats of industrial olivine with considerable transparent olive-green peridot were recovered from two anthills. Gem-quality cordierite was discovered by the WSGS in eastern Wyoming. These occur as transparent, sapphire-blue, crystal in gneiss, west of Wheatland. The cordierite occurs along with sillimanite, corundum, and kyanite.

Another deposit investigated by the WSGS was a corundum schist, known as the Red Dwarf ruby deposit near Jeffrey City in the Granite Mountains of central Wyoming. This schist has a strike length of 1,520 meters with widths up to 6 meters. The schist contains numerous, purplish-red, translucent and opaque, corundum crystals that range in size from microscopic to 5 centimeters across. From some specimens cut into cabochons, attractive, semiprecious gems have produced. Hundreds of gems and other mineral occurrences were described in another new WSGS publication: *Preliminary Report on Gemstones, Semi-precious Stones, Lapidary Materials, Ornamental Stones, and Other Unique Minerals and Rocks of Wyoming - A Collectors Guide* (Hausel and Sutherland, 1998).

Metals Exploration

Gold continued to attract interest in Wyoming. In the South Pass greenstone belt near the southern edge of the Wind River Mountains in the western part of the State, Newmont Exploration Inc. dropped its interest in the Lewiston district at South Pass, while a second exploration company immediately picked up the property. Some claim-staking activity was also reported in the Dickie Springs-Oregon Buttes area to the south, on one of the largest auriferous paleoplacers in North America. In the same area, private prospectors reported having some success. One Wyoming prospector recovered some nuggets including a 230-gram (7.5-troy ounce) nugget. Another prospector from Colorado found more than 40 nuggets at South Pass with the use of a metal detector.

Elsewhere in the State, interest was shown for large-tonnage deposits of gold. One of these, the Rattlesnake Hills alkalic province in central Wyoming, includes 50 Tertiary intrusives that disrupt an Archean greenstone belt. Past drilling by American Copper and Nickel Co., Inc., Canyon Resources Corp., and Newmont Mining Corp. on one of the intrusives identified a large-tonnage, low-grade gold deposit with an estimated resource of 7,800 kilograms (250,000 troy ounces), which is open at depth and laterally. Recent reevaluation of the drilling data has suggested that this resource could possibly be increased to 31,000 kilograms (1,000,000 troy

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ounces). At the Copper King property west of Cheyenne, evaluation of drill data by Mountain Lake Resources Inc. indicated a potential resource of more than 13,200 kilograms (425,000 troy ounces) of gold and 29,000 metric tons (63,000,000 pounds) of copper, with potential for expansion.

Some claim staking was reported for platinum-group metals (PGM) and in 1997 and 1998 there was interest in known iron and titanium deposits in the State. The PGM activity centered on Proterozoic-age, layered mafic complexes known as the Mullen Creek and Lake Owen complexes in the Medicine Bow Mountains, and the Puzzler Hill complex in the Sierra Madre Mountains of southeastern Wyoming. All three complexes have yielded highly anomalous mineralization. Other complexes of potential interest in the region include the Tony Ridge peridotite and the Laramie anorthosite-gabbro complex in the Laramie Range, and the Woods and Elkhorn Mountain complexes in the Sierra Madre. In regard to Wyoming's iron and titanium deposits, sizable iron resources occur in the South Pass and Seminoe Mountains greenstone belts, the Copper Mountain region, and in the Hartville uplift. Large resources are also found complexed with titanium in titaniferous magnetite in the Laramie anorthosite.

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TABLE 1
NONFUEL RAW MINERAL PRODUCTION IN WYOMING 1/ 2/

(Thousand metric tons and thousand dollars unless otherwise specified)

Mineral		1996 Quantity	1996 Value	1997 Quantity	1997 Value	1998 p/ Quantity	1998 p/ Value
Clays:							
Bentonite		3,030	98,400	3,340	140,000	3,330	132,000
Common		30	W	W	W	W	W
Gemstones		NA	11	NA	11	NA	11
Sand and gravel: Construction		3,420	14,700	3,090	12,300	3,850	15,800
Stone: Crushed		5,180	30,000	5,010	30,700	5,900	35,400
Zeolites	metric tons	(3/)	NA	(3/)	NA	NA	NA
Combined values of cement (portland), gypsum (crude), helium (Grade-A), lime, soda ash, and values indicated by symbol W		XX	935,000	XX	938,000	XX	880,000
Total		XX	1,080,000	XX	1,120,000	XX	1,060,000

p/ Preliminary. NA Not available. W Withheld to avoid disclosing company proprietary data; value included with "Combined values" data. XX Not applicable.
1/ Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
2/ Data are rounded to three significant digits; may not add to totals shown.
3/ Withheld to avoid disclosing company proprietary data.

TABLE 2
WYOMING: CRUSHED STONE SOLD OR USED BY PRODUCERS, BY KIND 1/

Kind	1996 Number of quarries	1996 Quantity (thousand metric tons)	1996 Value (thousands)	1996 Unit value	1997 Number of quarries	1997 Quantity (thousand metric tons)	1997 Value (thousands)	1997 Unit value
Limestone 2/	4	1,620	$5,330	$3.29	5	1,500	$6,700	$4.47
Marble	1	91	3,230	35.44	1	104	3,280	31.53
Granite	2	W	W	6.10	2	W	W	6.30
Quartzite	4	W	W	11.59	4	W	W	11.91
Volcanic cinder and scoria	1	W	W	8.62	1	W	W	6.17
Traprock	5	W	W	3.34 r/	5	W	W	3.97
Miscellaneous stone	--	--	--	--	1	97	577	5.95
Total	XX	5,180	30,000	5.79	XX	5,010	30,700	6.13

r/ Revised. W Withheld to avoid disclosing company proprietary data; included in "Total." XX Not applicable.
1/ Data are rounded to three significant digits, except unit value; may not add to totals shown.
2/ Includes "limestone-dolomite" reported with no distinction between the two.

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TABLE 3
WYOMING: CRUSHED STONE SOLD OR USED BY PRODUCERS
IN 1997, BY USE 1/ 2/

Use	Quantity (thousand metric tons)	Value (thousands)	Unit value
Coarse aggregate (+1 1/2 inch): Riprap and jetty stone	W	W	$9.63
Coarse aggregate, graded:			
Concrete aggregate, coarse	275	$2,310	8.41
Bituminous surface-treatment aggregate	93	286	3.08
Railroad ballast	W	W	6.88
Fine aggregate (-3/8 inch):			
Stone sand, concrete	21	199	9.48
Stone sand, bituminous mix or seal	W	W	6.08
Coarse and fine aggregates:			
Graded road base or subbase	W	W	4.89
Terrazzo and exposed aggregate	66	1,330	20.18
Other coarse and fine aggregates	126	1,510	12.01
Other construction materials	31	87	2.81
Agricultural: Other agricultural uses	1	23	23.00
Special:			
Mine dusting or acid water treatment	8	208	26.00
Whiting or whiting substitute	2	88	44.00
Other fillers or extenders	47	1,670	35.47
Roofing granules	(3/)	1,300	W
Unspecified: 4/			
Actual	3,070	17,000	5.53
Estimated	600	2,490	4.15
Total	5,010	30,700	6.13

W Withheld to avoid disclosing company proprietary data; included in "Total."
1/ Includes granite, limestone, limestone-dolomite, marble, miscellaneous stone, quartzite, traprock, and volcanic cinder and scoria.
2/ Data are rounded to three significant digits, except unit value; may not add to totals shown.
3/ Less than 1/2 unit.
4/ Includes reported and estimated production without a breakdown by end use.

TABLE 4
WYOMING: CRUSHED STONE SOLD OR USED BY PRODUCERS IN 1997,
BY USE AND DISTRICT 1/

(Thousand metric tons and thousand dollars)

Use	District 1		District 2		Unspecified districts	
	Quantity	Value	Quantity	Value	Quantity	Value
Construction aggregates:						
Coarse aggregate (+1 1/2 inch) 2/	--	--	W	W	--	--
Coarse aggregate, graded 3/	--	--	405	2,850	--	--
Fine aggregate (-3/8 inch) 4/	--	--	W	W	--	--
Coarse and fine aggregate 5/	W	W	576	3,970	--	--
Other construction materials 6/	--	--	W	W	--	--
Agricultural 7/	--	--	1	23	--	--
Special 8/	--	--	57	1,960	--	--
Unspecified: 9/						
Actual	--	--	2,980	16,400	97	577
Estimated	W	W	56	332	--	--
Total	653	3,450	4,260	26,700	97	577

W Withheld to avoid disclosing company proprietary data; included in "Total."
1/ Data are rounded to three significant digits; may not add to totals shown.
2/ Includes riprap and jetty stone.
3/ Includes concrete aggregate (coarse), bituminous surface-treatment aggregate, and railroad ballast.
4/ Includes stone sand (concrete), stone sand (bituminous mix or seal).
5/ Includes graded road base or subbase, terrazzo and exposed aggregate, and other combined coarse and fine aggregates.
6/ Includes roofing granules.
7/ Includes other agricultural uses.
8/ Includes mine dusting or acid water treatment and other fillers or extenders, and whiting or whiting substitute.
9/ Includes reported and estimated production without a breakdown by end use.

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TABLE 5
WYOMING: CONSTRUCTION SAND AND GRAVEL SOLD OR USED IN 1997,
BY MAJOR USE CATEGORY 1/

Use	Quantity (thousand metric tons)	Value (thousands)	Value per ton
Concrete aggregate and concrete products 2/	529	$2,750	$5.20
Asphaltic concrete aggregates and other bituminous mixtures	294	2,140	7.28
Road base and coverings	1,050	3,600	3.44
Fill	147	498	3.39
Snow and ice control	7	35	5.00
Other miscellaneous uses	146	560	3.84
Unspecified: 3/			
Actual	655	1,860	2.84
Estimated	269	880	3.27
Total or average	3,090	12,300	3.98

1/ Data are rounded to three significant digits; may not add to totals shown.
2/ Includes plaster and gunite sands.
3/ Includes reported and estimated production without a breakdown by end use.

TABLE 6
WYOMING: CONSTRUCTION SAND AND GRAVEL SOLD OR USED IN 1997,
BY USE AND DISTRICT 1/

(Thousand metric tons and thousand dollars)

Use	District 1		District 2		Unspecified districts	
	Quantity	Value	Quantity	Value	Quantity	Value
Concrete aggregate and concrete products 2/	280	1,730	249	1,020	--	--
Aspaltic concrete aggregates and road base materials	580	2,560	761	3,180	--	--
Fill	40	286	107	212	--	--
Other miscellaneous uses 3/	136	533	18	64	--	--
Unspecified: 4/	422	1,710	190	520	312	515
Total	1,460	6,820	1,330	5,000	312	515

1/ Data are rounded to three significant digits; may not add to totals shown.
2/ Includes plaster and gunite sands.
3/ Includes fill and snow and ice control.
4/ Includes reported and estimated production without a breakdown by end use.

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